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JOURNAL *of* EDUCATIONAL RESEARCH

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EDUCATIONAL MEASUREMENT IN THE SECONDARY SCHOOL

C. W. ODELL
University of Illinois

ALTHOUGH there has been educational measurement of some sort in the secondary school virtually since this type of school began, and although the type of measurement employed has varied from time to time, yet the new developments and the changes that have occurred within a comparatively few years represent such great departures from previous practices that we often hear the term "Educational Measurement Movement" applied to what has been done in this field in the last few decades. Occasional earlier prophetic workers, either in their words or in their actual practices, foreshadowed what was to come, but it was not until near the close of the nineteenth century that the modern educational measurement movement had its distinct beginnings.

It was little more than twenty years ago that the first standardized measuring instruments suitable for secondary-school use appeared. After the close of the World War such instruments began to become available in fairly large numbers and to be administered to many pupils, and it was only five years ago when the first two comprehensive books[1] devoted to secondary-school measurement appeared, to which even now only one other volume[2] has been added. Since that time, development in the number of tests, the uses to which they are put, and the growth of a critical attitude toward them, have been rapid, and to date do not appear to be slackening in pace. The growth reached at present may be indicated, although by no means adequately represented, by the number of tests produced. In the writer's index of standardized and other

[1] Symonds, P. M. *Measurement in Secondary Education.* (New York: The Macmillan Company, 1927), 588 pp.

Ruch, G. M., and Stoddard, G. D. *Tests and Measurements in High School Instruction.* (Yonkers-on-Hudson, New York: World Book Company, 1927), 381 pp.

[2] Odell, C. W. *Educational Measurement in High School.* (New York: The Century Company, 1930), 641 pp.

published tests, he has listed more than six hundred in the subjects commonly considered as being secondary-school subjects. These are in addition to many others in subjects chiefly taught in elementary schools or in institutions of higher learning, but having some place in secondary schools, and in addition to the large number of tests and scales of general intelligence, vocational aptitude and ability, personality and character, study habits, and other traits which it is sometimes found desirable to rate or measure. Of this number, well over half are at present generally available, and a large percent of these are of sufficient merit to be worth using in some situation or other. Moreover, the results of the emphasis on measurement have been manifested very widely in the increased attention given by teachers and supervisors to the examinations which they construct for their own use, including both the improvement of the traditional or essay examination and the development of the new-type or short-answer test.

It is difficult to choose a few events or studies in the development of secondary-school measurement as being the most outstanding. The writer elsewhere[3] has attempted to outline the history of the educational-measurement movement, and in reviewing his attempts to do so, finds that he has mentioned few significant developments which pertain exclusively to the secondary school. Several outstanding projects or lines of growth apart from that of tests in the various school subjects, however, may well be referred to here.

One important line of activity is the prediction of educational, and, to a somewhat lesser degree, of vocational success of pupils in high school and afterward. Such studies as those of Flemming[4] and Ross[5] in pre-

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[3] Monroe, W. S., et al. "Research in Educational Measurement," in *Ten Years of Educational Research, 1918-1927, University of Illinois Bulletin,* Vol. 25, No. 51, Bureau of Educational Research Bulletin No. 42. (Urbana: University of Illinois, 1928), Chapter IV.

Odell, C. W. "The History and Present Status of the Educational Measurement Movement," *Educational Measurement in High School,* (New York: The Century Co., 1930), Chapter II.

[4] Flemming, C. W. "A Detailed Analysis of Achievement in the High School: The Comparative Significance of Certain Mental, Physical, and Character Traits for Success," *Teachers College, Columbia University, Contributions to Education,* No. 196. (New York: Bureau of Publications, Teachers College, Columbia University, 1926), 209 pp.

[5] Ross, C. C. "The Relation Between Grade School Record and High School Achievement: A Study of the Diagnostic Value of Individual Record Cards," *Teachers College, Columbia University, Contributions to Education,* No. 166. (New York: Bureau of Publications, Teachers College, Columbia University, 1925), 70 pp.

dicting scholastic success in the high school, of Henmon and Holt[6] in Wisconsin, of Johnston[7] and others at the University of Minnesota, of Toops[8] for the Ohio College Association, of Douglass[9] at the University of Oregon, of Woody for the higher institutions of Michigan, of the present writer[10] for Illinois high-school graduates, and of many other workers in this field, offer data showing the degree to which scholastic success in general and in particular subjects can be predicted from earlier scholastic records, intelligence test scores, trait ratings, and various other items of information concerning those for whom predictions are being made. In addition to those measures not primarily intended for but nevertheless valuable for prognostic purposes, a number of tests and series of tests constructed particularly for such ends have been employed. These include many general intelligence tests and such prognostic tests in the school subjects as the Iowa Placement Examinations, particularly the Aptitude Tests thereof, the prognostic tests by Orleans and others in mathematics and foreign language, and the Van Wagenen Reading Scales in history, literature, and general science. Moreover, some of the general survey tests covering achievement in the more commonly studied high-school subjects have been intended and used at least as much for predicting success in higher institutions as for

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[6] Henmon, V. A. C., and Holt, F. O. "A Report on the Administration of Scholastic Aptitude Tests to 34,000 High School Seniors in Wisconsin in 1929 and 1930," *Bulletin of the University of Wisconsin*, Serial No. 1786: General Series No. 1570. (Madison, Wisconsin: Bureau of Guidance and Records of the University of Wisconsin, June, 1931), 104 pp.

[7] Johnston, J. B. "Predicting Success in College at the Time of Entrance," *School and Society*, XXIII (January 16, 1926), pp. 82-88.

Johnston, J. B. "Predicting Success or Failure in College at the Time of Entrance," *School and Society*, XIX (June 28, 1924), pp. 772-76; XX (July 5, 1924), pp. 27-32.

Johnston, J. B. "Tests for Ability Before College Entrance," *School and Society*, XV (April 1, 1922), pp. 345-353.

[8] Toops, Herbert A. "Prediction of Scholastic Success in College," *School and Society*, XXV (February 26, 1927), pp. 87-88.

[9] Douglass, Harl R. "The Relation of High School Preparation and Certain Other Factors to Academic Success at the University of Oregon," *University of Oregon Publication*, Vol. 3, No. 1. (Eugene, Oregon: University of Oregon, September, 1931), 61 pp.

[10] Odell, C. W. "Predicting the Scholastic Success of College Freshmen," *University of Illinois Bulletin*, Vol. 24, No. 41, Bureau of Educational Research Bulletin No. 37. (Urbana: University of Illinois, 1927), 54 pp.

Odell, C. W. "Predicting the Scholastic Success of College Students," *University of Illinois Bulletin*, Vol. 28, No. 5, Bureau of Educational Research Bulletin No. 52. (Urbana: University of Illinois, 1930), 43 pp.

evaluating the efficiency of high-school work. Among these are the Training Tests of the Iowa Placement Examinations, the Sones-Harry Achievement Tests, and the North Carolina Senior Examination.

A notable project along the same line involving coöperation between the secondary school and the college has been under way since the fall of 1928 in Pennsylvania. Its general title is "A Study of the Relations of Secondary and Higher Education in Pennsylvania." Its chief feature, at least insofar as the measurement phase is concerned, is that about twelve thousand seventh-grade pupils were measured at the beginning of the experiment, and their accumulated records, including both test results and other items of data, are being carefully secured from year to year. It is proposed that those pupils who appear to be of outstanding capacity shall be segregated and offered work devised especially to meet their needs. In planning this work the colleges they intend to enter have been consulted. The study also involves a large testing program in the colleges of the state, for which purpose the College Sophomore Examination, constructed by B. D. Wood and others, which covers eighteen high-school and college subjects in addition to intelligence and general culture, in five sessions of two or more hours each, has been constructed. Four reports of progress made in this study have been issued from time to time.[11]

In connection with the prediction of the success of high-school graduates entering college, the unusual activity displayed by schools and colleges of engineering is noteworthy. Prominent in this work are the Educational Research Committee, organized by the Engineering Foundation, and the Committee on Comprehensive Examinations, by the Society for the Promotion of Engineering Education. The tests most often used for this purpose have been general intelligence tests, the Iowa Placement Examinations, and others of the series already mentioned in this discussion. However, a number of tests designed specifically for this purpose have been employed, and some new techniques of scoring, which lessen the time required therefor, have been devised. Among the earlier series of tests intended for this purpose are the Thurstone Vocational Guidance or Engineering Aptitude Tests and a series worked out by the College of Engineering of the University of Illinois. More recently, C. V. Mann and others, working especially at the Missouri School of Mines, have

[11] These progress reports are published by the Carnegie Foundation for the Advancement of Teaching.

produced a number of tests for measuring both aptitude and achievement in various phases of engineering, such as drawing, structural work, descriptive geometry, lettering, reading drawings, and so forth. The "Checkgrid" answer blanks and method of scoring, devised in connection with these tests, have more than doubled the rate at which objective or short-answer tests can be scored. The details of this method of scoring vary for different forms of exercises, but the general principle is that either by perforating many papers at once, or by using a ditto machine, the correct answers are indicated on each page, so that those given by students can be very rapidly compared with them.

Another outstanding group of studies deals with the new-type, short-answer, or objective test on the secondary school level. Although many students in the field have contributed something along this line, the work of Ruch and his collaborators easily deserves first place. In several volumes,[12] in addition to numerous articles in periodicals, yearbooks, and other sources, they have presented many critical data concerning such tests and numerous suggestions as to how to construct and employ them.

A prominent development in certain states within the last three or four years is that of state-wide series of achievement tests over the high-school subjects designed to stimulate a desirable type of competition among high schools and their pupils and, incidentally, to exert a constructive influence on school curricula. Probably the best known and best established series of such tests is that used in the Iowa Academic Contests, which began in 1929, and have been under the direction of Lindquist. These are held annually each spring and include two chief parts, the Every-Pupil Contest and the State Scholarship Contest.[13] The former is a contest between entire high schools divided into four size groups, the latter is one between individual pupils. At present, about four hundred Iowa high schools enter the annual contest and give one-

[12] Ruch, G. M. *The Improvement of the Written Examination.* (Chicago: Scott, Foresman and Company, 1924), 193 pp.

Ruch, G. M. *The Objective or New-Type Examination.* (Chicago: Scott, Foresman and Company, 1929), 478 pp.

Ruch, G. M., and Rice, G. A. *Specimen Objective Examinations.* (Chicago: Scott, Foresman and Company, 1929), 324 pp.

Ruch, G. M., *et al. Objective Examination Methods in the Social Studies.* (Chicago: Scott, Foresman and Company, 1926), 116 pp.

[13] Lindquist, E. F. "The Iowa Academic Contest: Its Purposes and Possibilities," *Bulletin of the State University of Iowa,* New Series No. 577. (Iowa City, Iowa: University of Iowa, Dec. 15, 1930), 40 pp. Also other minor publications.

hour objective achievement examinations in the fundamental high-school subjects to all their pupils. The large number of schools and pupils participating makes possible the securing of reliable norms, not only for the group as a whole, but for schools and pupils in various classifications. A somewhat similar program was developed in Kansas, and later in Ohio, by E. R. Wood. This program also includes an Every-Pupil Test and likewise a General Scholarship Test for selected seniors.[14] These tests cover both the fundamental high-school subjects and some of those taught in elementary school. Also, the Ohio Education Association, the State Department of Education, and the Bureau of Educational Research of Ohio State University, have been coöperating in giving tests, for which records of earlier scores dating back to 1920 or thereabouts were available, and in comparing the results to determine what, if any, significant changes are occurring in the achievements of pupils. From this practice has developed a continuous testing program in which tests in one major group of subjects will be prepared and given each year. There are five groups, with the result that the same field will be tested at five-year intervals. More recently, a High School Testing Service for Indiana has been inaugurated under the auspices of the four state-supported higher institutions of learning and with the direction of a committee under the leadership of Remmers of Purdue University. The first testing program, carried out in the spring of 1931, was participated in by about two hundred and forty high schools.[15] In this project also, every pupil taking the subject in each participating school must take the tests therein. No individual or selected pupil contest is included, as is the case in the other states just mentioned. The purposes are stated to be particularly the singling out of pupils needing attention, and assistance in curricular revision in local high schools. In addition to testing projects of this type, there have been more or less state-wide testing programs in the secondary schools of several other states based on the use of already available standardized tests instead of those constructed for the particular occasion. The Bureau of Educational Reference and Research at the University of Michigan has been one of the foremost agencies in promoting such a program.

[14] The Ohio tests are described in a number of publications issued by the State Department of Education at Columbus.

[15] Remmers, H. H. "The Achievement of Our High Schools—Results of the State High School Testing Program, 1930-1931," *Bulletin of Purdue University* Vol. 32, No. 2, (Lafayette, Indiana: Purdue University, October, 1931), 30 pp.

In the secondary school, as elsewhere, the measurement of personality and character traits and related matters has been receiving a considerable amount of attention recently. Among the more significant and comprehensive investigations which are especially concerned with the secondary field is that by Symonds who is studying the problem of measuring the personality adjustments of high-school pupils.

At present, work is being carried on in the development of so many new tests that it is hazardous to single out a few of these as being especially noteworthy. Moreover, the writer is doubtless unacquainted with the majority of projects of this sort since they usually receive little or no publicity until they at least approximate completion. However, he will mention as among the more important undertakings of this sort the Iowa Aptitude and Unit-Achievement Tests in Algebra by Greene and Piper; a combination test and exploratory learning situation for music, dealing chiefly with musical instruments, by Lamp; a series of tests of sight-singing by Knuth; a modern foreign language prognostic test by Barry; and a series of tests on four hundred books and selections often read in literature, under the general direction of Wells.

Since the modern movement in secondary-school measurement has been intensive for only a comparatively few years, it follows that there are many unsolved problems and needed investigations. It is difficult to say which of these are most fundamentally needed, and when such a statement is made it is but a matter of personal opinion. The writer will venture, however, to offer a few suggestions in this regard, even though doing so may expose him to the criticism he has heard in another connection, that those who publish lists of unsolved problems usually include therein problems in which they are interested, but which they do not know how to attack. Foremost in the list of fundamental needed investigations, he would place one that is by no means limited to the secondary-school level. This is the general problem of the effect upon pupils' achievements and attitudes of the various types of measuring instruments employed, and of the various conditions under which they are used. Many studies offer some evidence to the effect that the use of particular types of tests, under certain conditions, stimulates pupils to greater learning activity or produces other results, but practically all of these investigations have dealt with situations in which there were so many uncontrolled or unmeasured factors that the interpretations of the results are of at least doubtful validity. The few studies which deserve to be rated higher than this yield conclusions that, even when

combined, are very fragmentary and partial with regard to the general problem, or even in relation to its main divisions. The results are practically always limited in time to a relatively short period, and measure temporary attainment or understanding, totally or almost totally neglecting long-time outcomes. We need to know what is the effect of the various measurement procedures upon pupils, not only when the tests are employed and immediately thereafter, but at the end of the pupils' secondary-school course, through and at the end of their college or university course, and thereafter.

Although, as is indicated by a portion of the previous discussion, considerable attention has already been given to the prognosis of success in high school and college and in vocations, the writer believes that better prediction of such success is still one of the significant problems needing attention. Among the factors that should contribute to a better solution thereof are the construction of more prognostic tests in the various school subjects; the development of more valid and reliable measures of success, especially in the vocational field, which implies better definitions of what constitutes success; and long-time studies which follow children from their earliest school entrance, or even before, through the elementary school, the secondary school, and higher institutions, and at least a considerable period of their lives after all formal education has been completed.

Another needed line of attack which has already been recognized and has received considerable attention, but still demands more, is the critical study of the tests existing at present and of those to appear in the future. Although the supply of tests in some fields or portions of fields is very small, and although in certain fields in which may be found relatively large numbers of tests there are still none which are even approximately satisfactory, yet the writer believes there is at present and probably will continue to be for some time in the future, if not permanently, greater need for critical evaluation of the available tests and determination of just when they should be used and what the results obtained signify, than for the construction of large numbers of new tests. Ruch and those associated with him have probably been the outstanding group in making studies of high-school tests,[16] especially as to their reliability, and are continuing this work, but cannot well do all that is needed.

[16] The results of these studies have been published in the volume by Ruch and Stoddard previously referred to, in numerous magazine articles, and elsewhere.

Although the writer would emphasize the critical study of tests existing at present rather than the construction of new measures, there are several particular types of tests the need for which he wishes to mention. One type already referred to is the prognostic test. The second is the unit test over a comparatively small portion of work, usually that to be covered in from two to six weeks. Since many high schools are organizing much of their work according to the so-called unit plan, such tests should be provided for use. They will usually tend to be largely diagnostic in their nature, covering the unit in some detail and yielding results which suggest to the instructor those portions thereof that need to be re-emphasized before going on to the succeeding unit. A beginning already has been made in the construction of unit tests, but in most high-school subjects there is either none at all or very few.

In conclusion, the situation in the field of secondary-school measurement may be summarized as being quite similar to that in most other lines of development which have experienced unusual attention and growth during a relatively short period. A great deal has been done, but much of the work has been decidedly uncritical and has consisted of somewhat isolated undertakings not closely related to other activities in the same field. There are many measuring instruments now commonly available, whose worth has been but slightly tested, and there are many gaps in the complete whole of desirable achievement, so without question much needs to be done by way of analysis and synthesis of past achievement and accomplishment as well as in terms of starting new activities.

THE PROBLEM OF DATES IN THE TEACHING OF HISTORY AND IN MEASUREMENT*

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SEVERAL previous investigations[1] have been made of factual load in United States history with various objectives in mind. The present investigation of factual load (date load) is in agreement with the previous investigations in showing a very high burden in routine information in most texts and other instructional materials. There is good evidence that much of such materials presented in courses in both public schools and colleges is not learned or, at least, is soon forgotten.[2] It is important to know whether this heavy burden of fact may not in part account for this breakdown of efficiency in learning. Another consideration leading to the present investigation has to do with the educational background of college courses. Investigations of failing students in college have shown that many of them suffer severely because of lack of essential background information for college work. It seems, therefore, highly important to determine minimum essentials of preparation and to formulate tests or other means of locating deficiencies along such lines.

AN ANALYSIS OF TEXTBOOKS IN AMERICAN AND EUROPEAN HISTORY

An analysis was first made of the main topics in five textbooks in American history and five textbooks in European history.[3] Also, an

* This paper summarizes certain portions of a thesis presented in partial fulfillment of the requirements for the doctor's degree at Ohio State University. The writer wishes to express his obligations to Dr. S. L. Pressey for assistance on this work.

[1] Wooters, J. E. "Elementary American History Standards," *School and Home Education*, XXXIV, 1914; Pressey, L. C. "An Investigation of the Technical Vocabularies of the School Subjects," *Educational Research Bulletin*, April 30, 1924; Swisher, J. A. "The Historical Information Essential for the Intelligent Study of Civic Problems," Seventeenth Yearbook of the National Society for the Study of Education, Part I, 1918; Moore, E. C. *Minimum Course of Study*. The Macmillan Company, 1923; Osburn, W. J. *Are We Making Good at Teaching History?* Bloomington, Illinois: Public School Publishing Company, 1926; Bagley, W. C. "The Analysis of Eight Current Histories," *The Committee of Eight Report*, 1909.

[2] Pressey, S. L. *Research Adventures in University Teaching*. Public School Publishing Company, Bloomington, Illinois, 1927.

[3] In European history: Robinson, J. H., and Beard, C. *History of Europe: Our Own Times* (Ginn and Company, 1927); Webster, H. *Modern European History* (Heath and Company, 1925); West, W. M. *A Short History of Modern Peoples* (Allyn and Bacon, 1925); Hazen, C. W. *Modern Europe* (Holt and Company, 1920); Hayes, C. J., and Moon, P. T. *Modern History* (Macmillan and Company, 1923).

In American history: Bourne, H. E., and Benton, E. J. *American History* (Heath and Company, 1925); Fish, C. R. *American History* (American Book

analysis was made of the main topics of one history of American literature and four histories of English literature. The five texts in American history were studied to find possible changes as compared with the findings of earlier textbook studies. The European history textbooks were studied partly for the comparison with the texts in American history, but more because it was hoped that dates of importance in both American and European history and which might serve as coördinating points could be found. This concept of the coördinating date might then prove a valuable criterion in the selection of important dates, and the number and frequency of mention of such dates would give a rough indication of the extent of such coördination. These same general purposes were back of the studies of histories of literature.

TABLE I

FREQUENCY WITH WHICH DIFFERENT DATES OCCUR IN TEXTBOOKS IN AMERICAN AND EUROPEAN HISTORY

Frequencies	American History						European History					
Texts	A	B	C	D	E	Medians	A	B	C	D	E	Medians
40-plus				1			1	1		2	4	1
38-39								1				
36-37			2	1			1	1				
34-35							1				2	1
32-33	1		1					1				
30-31	1							1		1		1
28-29							1	1		1		2
26-27	3	2	1			1		2	1	1	1	
24-25					1	1	1			2	2	1
22-23	2	1	1	2			2					1
20-21	1	1	3	1	2	1	3				3	
18-19	1	3	1	1	2	2	1			3	4	2
16-17	2	4		3	1	2	2	2	2	6	3	3
14-15	5	4	4	5	3	2	2	2	4	4	3	2
12-13	14	2	8	8	3	5	6	2			4	1
10-11	13	10	12	5	3	7	6	5	4	15	9	6
9	8	6	8	3	3	6	3	5	4	3	3	6
8	10	2	11	10	2	8	6	2	4	12	2	5
7	8	11	17	11	9	13	5	5	5	8	6	6
6	15	13	10	13	15	12	21	5	15	8	11	9
5	15	20	33	10	9	15	14	18	12	17	6	12
4	21	25	26	20	19	24	12	16	16	11	8	15
3	34	22	24	32	24	30	27	25	18	15	32	22
2	33	33	36	47	54	42	54	32	30	28	39	37
1	84	45	55	63	91	60	37	96	95	44	79	57
Totals	271	204	253	236	241	231*	206	223	210	182	221	190*
Total Mentions	1352	1025	1356	1070	852		1081	934	685	1147	1120	

*In addition, there were 121 dates in American history and 146 in European history which occurred in only one or two texts and so had a median frequency of 0. The total number of different dates mentioned in all five American history texts was thus 352, and in the European texts, 336.

Company, 1925); Guitteau, W. B. *Our United States* (Silver Burdett Company, 1924); Muzzey, D. S. *American History* (Ginn and Company, 1925); West, W. M. *American History* (Allyn and Bacon, 1926).

In this analysis the procedure was as follows: (1) The writer went through each book and listed each date as it occurred, tabulating duplicates. The result was a list of the different dates occurring in each book with the frequency with which each occurred. (2) These frequencies were tabulated for each text, the resulting table showing for each book the number of dates appearing one, two, and three times up to 40 times or more for each date: thus 1860 appeared, in five American history textbooks, 40, 20, 26, 25, and 15 times with a median frequency of 25. These median frequencies of dates in American and European history are shown in the last columns in Table I.

The totals for Table I show that these secondary-school history texts contain from 182 to 253 different year dates specifically referred to, with the total number of mentions running from 685 to 1356. Curiously enough, the European histories average slightly fewer dates than the American histories (the median number of different dates is 210 as compared with 241, but median mentions of 1081 as compared with 1070). A median of 27 percent of the dates in American history, and 36 percent in European history are mentioned only once. In both American and European history only 21 dates appear ten or more times. These dates are as follows (the figure in parenthesis is its median frequency):

American history: 1775 (14), 1824 (11), 1862 (19), 1896 (10), 1776 (10), 1840 (13), 1863 (13), 1900 (12), 1800 (11), 1850 (20), 1865 (13), 1814 (10), 1812 (27), 1860 (25), 1890 (14), 1880 (11), 1919 (17), 1820 (12), 1861 (17), 1917 (17), 1920 (11)

European history: 1789 (24), 1832 (10), 1871 (22), 1914 (48), 1792 (17), 1848 (35), 1878 (11), 1915 (15), 1800 (11), 1866 (11), 1898 (10), 1916 (17), 1815 (28), 1867 (12), 1905 (14), 1917 (30), 1830 (16), 1870 (19), 1907 (10), 1918 (28), 1919 (18).

It will be noted that in American history, 1860 is the most frequently mentioned, and in European history it is 1914. Only four dates (1800, 1914, 1917, and 1919) are common to both lists; and of these four, 1800 is used as a reference point rather than as a dating of any special event, while 1914, 1917, and 1919 all refer to the World War. In short, if frequency of mention of a date may be taken as some indication of its importance, these results suggest a distinct lack of interdependence of historical crises (as treated in high-school texts) in American and European history.

The general situation in the four histories of English literature is shown by the following summary:

Text	A	B	C	D
Total Different Dates	290	412	377	216
Total Mentions	719	1317	1096	386

There is a heavy date load, and a conspicuous lack of coördination of the English literature texts with each other and with the histories. Only one date (1850) occurs in three of the four English literature texts over 10 times. This date is not among the 21 European history dates having a median frequency of 10 or more.

AN ANALYSIS OF DATE-EVENT RELATIONSHIPS

Our analysis so far has considered only the frequency with which different years were specifically mentioned, not why they were mentioned. The next natural step was to determine for each mention of each date the event with which it was there associated and which presumedly made the date significant. In making this analysis a simple elementary school history text (Woodburn and Moran) was used. The assumption was that in such a volume the important events of history would receive a relatively greater emphasis. The results of this analysis showed that 233 different dates were mentioned in connection with 715 different events. The total number of mentions was 782. In all, 11 different dates were associated with 10 or more events each. Roughly, it appeared that most frequently occurring dates are those which are associated with the greatest number of events rather than many times in connection with one event, but these events were likely to be closely related. Thus twelve events gave occasion for 15 mentions of 1914, as follows: World War begins (3 mentions), Panama Canal completed, Federal Trade Commission established (2 mentions), Act approved, Wilson declares America neutral, Austrian prince assassinated, Cause of War, Department of Labor publications, Great Britain enters the War, First Battle of the Marne, Turkey enters the War, Capital invested in factories.

DATES APPEARING IN STANDARD TESTS

Since material is selected with great care in building tests, it seemed proper to examine several standard tests to find what dates appear in or are required by them. Nine tests[4] were therefore analyzed as to (1)

[4] Barr, A. S. *Diagnostic Tests in American History.* Bloomington, Illinois: Public School Publishing Company, 1918; Witham, Ernest. *Comprehensive Seventh and Eighth Grade History Tests.* Newark, New Jersey: J. L. Hammett Company

dates required or called for, and (2) dates mentioned. Briefly, it may be said that two of the tests required no dates; the greatest number called for by any one of these tests was 15; the median number was 6. Only 7 different dates were called for in two or more tests; they were 1492, 1607, 1916, 1620, 1643, 1776, and 1789. The range in dates mentioned was from 9 to 64, and the median 20.

This survey of standard tests did not give much help in selecting important dates but it did suggest a special test dealing with date-event relationships.

KNOWLEDGE OF COLLEGE STUDENTS CONCERNING DATES-AND-EVENTS IN AMERICAN HISTORY

In this investigation an inventory was taken to show the number of dates, the number of events, and dates and events remembered by college students under various given conditions.

Two general assumptions were back of this special investigation: (1) It was felt that college students' knowledge of a date would be a result of their total education up to that time and therefore evidence of its frequency of mention. (2) It was believed that adults would remember dates and events approximately in proportion to the significance which they had found in these dates and events.

Three methods of gathering data were used: (1) Students were asked to write down all date-event relationships that they could remember, (2) Students were given a list of 32 most important dates, as determined by previous work, and asked to supply events, (3) Students were given a list of events that were associated with the above mentioned 32 most important dates and asked to supply the correct dates. A total of 103 students, mostly sophomores and juniors, took the first test, and 112 the second and third tests.

Where both dates and events were called for, the total number of different dates correctly mentioned was 70; the median was 7. In supplying events, the median number of attempts was 13 and the median number correctly written was 9. In supplying dates, the median number

1924; Lynch, I. R. *Lynch American History Tests.* Minneapolis, Minnesota: Educational Test Bureau, 1926; Davis, S. B. *Exercises in United States History.* School of Education, University of Pittsburgh, 1920; Ely, Lena, and King, Edith. *Tests in American History.* Los Angeles, California: Research Service Company, 1927; Gregory, C. A. *Gregory Tests in American History.* Bureau of Educational Research, University of Oregon; Carman, H. J., Barrows, T. N., and Wood, Ben D. *Columbia Research Bureau American History Tests.* World Book Company, 1926; *Iowa General Information Test in American History.* Iowa City: Bureau of Educational Research and Service, University of Iowa, 1928.

of attempts was 15 and the median number that were right was 8. A combination of the results of these three tests gave a list of dates that agrees fairly well with other lists of dates obtained by the application of other criteria. The date best known by college students was 1492. The dates 1914, 1776, and 1812 follow in order.

Considering the amount of time devoted to the study of history the results of these three tests are rather disappointing. Dates are either not considered of much importance in American history or there is insufficient emphasis placed on important dates, or it is because of poor methods of teaching and learning.

SELECTION OF THE MOST IMPORTANT DATES

From the above data and the following material the writer has attempted to prepare a list of material containing important dates: Bagley's list of 25 most important dates, Swisher's list of 20 dates, Wooter's list of 20 dates, Moore's curriculum committee list of 20 dates, and Osburn's list of the 22 dates appearing in examinations more than ten times. These different lists were then combined. The combination gave a total of 72 different dates, of which 34 occurred but once, 10 of them in only two of the ten lists. The 26 dates occurring in three or more of the lists are as follows (The numbers in parenthesis indicate the number of lists in which each date appeared): 1492 (3), 1607 (5), 1619 (4), 1620 (5), 1775 (6), 1776 (7), 1783 (4), 1787 (5), 1789 (5), 1803 (4), 1812 (7), 1820 (5), 1823 (3), 1848 (3), 1850 (6), 1860 (4), 1861 (4), 1862 (3), 1863 (6), 1865 (6), 1890 (4), 1898 (6), 1900 (4), 1914 (4), 1917 (5), 1918 (3).

In this list 1890 and 1900 probably appear in part because they are decade and century reference points rather than because of the events happening in those years. The combined date 1775-1783 for the Revolutionary War and the similarly combined date 1860-1865 for the Civil War might perhaps well be substituted for the eight dates included in these war periods. There then remains a total of eighteen dates, each associated with a notable event, and "punctuating" in a very reasonable way the course of American history from Columbus to the present.

SUMMARY

1. Analysis of date load in five high-school American histories and five histories of Europe, shows the date loads to run from 685 to 1356 mentions, of from 182 to 253 different dates. Approximately 30 percent of the dates in each text are mentioned only once.

2. Of the dates in American history mentioned ten or more times, ten refer primarily to military events. Only four are found in a similar list in European history.

3. Analysis of four histories of literature shows a similar date load, and little correlation with date material in the political histories.

4. Intensive study of a single text as to number of different events mentioned in connection with a given year showed 715 different events specifically dated in 233 different years; eleven years were mentioned in connection with ten or more events each.

5. Analysis was also made of date load in certain standard tests.

6. Date-event knowledge of college students was found exceedingly meagre.

7. On the basis of all the data a list of most important dates is suggested.

THE CORRELATION BETWEEN READING RATE AND COMPREHENSION

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CORRELATIONS PREVIOUSLY REPORTED

A large number of studies have reported correlations for scores in rate of reading with scores in comprehension of reading material. Although the correlation coefficients have differed widely in size, most of those found in the earlier studies were high enough to suggest that there is considerable association between ability to read rapidly and ability to understand the meaning of what is read. Pressey and Pressey,[1] for example, reported some years ago that the correlation of rate and comprehension scores made on the Monroe Standardized Silent Reading Test by 147 seventh-grade pupils was .72. This correlation, however, is probably explained in part by the fact that the comprehension score on the Monroe Test is also a rate score, as the test has a short time limit and it is impossible for one to make a high comprehension score unless he reads rapidly.

Gates,[2] in a study of several reading tests about a decade ago, also found high correlations between rate and comprehension. In the summary and conclusions of the study, he states, "Rate and comprehension are very highly correlated; the composites for the two yield an uncorrected correlation of 0.84 ± S.D. 0.08." The next statement, however, offers a partial explanation for the high correlation. It reads:

"Most of the tests do not differentiate *rate* from *comprehension* for the correlations of rate tests with the composite of comprehension are about the same as with the composite of rate, and the correlations of comprehension tests are about the same with rate as with comprehension."[3]

A question naturally arises about the amount of correlation that exists between rate and comprehension when these aspects of reading ability are differentiated by the test. Some recent studies indicate that, under such conditions, the agreement is not very close. For instance,

[1] Pressey, S. L., and Pressey, L. C. "The Relative Value of Rate and Comprehension Scores in Monroe's Silent Reading Test, as Measures of Reading Ability," *School and Society*, XI (1920), pp. 747-49.

[2] Gates, Arthur I. "An Experimental and Statistical Study of Reading and Reading Tests," *Journal of Educational Psychology*, XII (1921), pp. 445-62.

[3] *Op. Cit.*, p. 460.

Eurich[4] has reported twenty-six correlation coefficients for rate of reading and comprehension. All except two correlations, which were found from scores on the Monroe Standardized Silent Reading Test, were derived from rate and comprehension tests that were independent of each other. The average of the twenty-six correlations was .31, which "indicates a positive but not close relationship between rate of reading and comprehension."

The present article will report further correlations between rate scores and comprehension scores derived from tests that differentiate clearly between rate and comprehension.

CORRELATIONS FOUND IN THIS STUDY

During the construction and standardization of a reading test, five forms of a rate test, consisting of interesting stories, each of which was 1200 words in length, were given to eighty pupils in the seventh grade of the University of Chicago High School. In each form of the test the pupils were permitted to read the entire story before they were tested on their understanding of it. Rate of reading was measured in average number of words per second read during an interval of two hundred seconds.[5] The pupils were informed before they began to read that they would be required to answer questions on the reading matter, and the directions and organization of the test were designed to impress this fact upon their minds. The directions, which were printed on the first page of the booklet and were read aloud by the examiner before the test began, were as follows:

"This test contains a story for you to read and some questions for you to answer after you have read the story. When the signal is given (but not before) turn to page 2. Most of that page contains some questions printed upside down. Do not try to read the questions, but look at the *bottom* of the page where the story begins. The examiner will read the lines at the bottom of the page aloud and you will read them silently. When the examiner reaches the end of the last line, he will stop reading and you will turn to the next page and continue to

[4] Eurich, Alvin C. "The Relation of Speed of Reading to Comprehension," *School and Society*, XXXII (September 20, 1930), 404-6.

[5] An interval of two hundred seconds of reading time had previously been found to give more reliable rate scores than a shorter time interval. It had also been found that rate of reading for two hundred seconds was highly correlated with rate of reading the entire selection. This interval was used instead of timing the whole story because it simplified the administration of the test to groups of pupils.

read. From time to time, the examiner will say 'mark'. Put a circle around the word you are reading when that signal is given, and *keep right on reading.* When you finish reading, turn back to page 2, turn the page around and answer the questions which are based on the exercise. Do not read any part of the material more than once. Read as fast as you can read *understandingly,* but no faster, as *you cannot answer the questions unless you know what you have read.*"

Comprehension of the material in each form of the test was measured with ten multiple-choice questions which the pupils answered as soon as they finished reading the selection. The following questions, taken from Form 1 of the test, illustrate the kind of questions used.

1. The cub whimpered because (1) he was cold (2) he was tired (3) he was hungry (4) he was lost (5) he was afraid.

2. The bear retreated from the musk-oxen as if in terror because she (1) was afraid of them (2) wanted them to think she had gone away (3) was anxious for the safety of her cub (4) hoped to be pursued (5) was in a playful mood.

The pupils were allowed as much time as they needed to read the story and answer the comprehension questions. Thus, the comprehension score was free from the influence of the time element.

The scores on rate of reading each of the forms of the test were correlated with the scores on the comprehension questions based on the same material. The correlation coefficients are shown in Table I.

TABLE I

CORRELATIONS BETWEEN RATE AND COMPREHENSION ON FIVE FORMS OF A READING TEST

Form	Number of Cases	r P.E.
1	80	.144 ± .074
2	80	.208 ± .072
3	80	.082 ± .074
4	80	.131 ± .074
5	80	.118 ± .074

All the correlations in Table I are positive, but low. There is no certainty that any of the correlation coefficients is significant, as none of them is as much as three times its probable error. It is possible, nevertheless, that the low correlations between rate and comprehension in these cases are due to the fact that the reliability of the scores used in computing them was not very high.

The mean of the intercorrelations among the scores on the different forms of the rate test was .797 and the mean of the intercorrelations among the comprehension scores on the various forms of the test was

only .600. However, when the Spearman-Brown formula[6] for predicting the reliability of lengthened tests was applied to the preceding mean correlations, it was found that the reliability of the total score on all five forms of the rate test was .95 and that the reliability of the total score on all five forms of the comprehension test was .88. These coefficients indicate that the total scores on the two types of tests were highly reliable.

The fact that the total rate scores and the total comprehension scores appeared to have high reliability made it possible to avoid the limitation resulting from the rather low reliability of the individual tests by correlating the total scores made by the eighty pupils on the five rate tests with their total scores on the five comprehension tests. It was found that

$$r = .205 \pm .072$$

This correlation is likewise very low. It suggests that the slow readers understood the test material about as well as did the rapid readers.

This finding was verified by using a similar procedure for measuring the reading rate and comprehension of ninety-two pupils in the junior class of the University of Chicago High School. The pupils were timed while they read three types of historical material after they had been informed that they would be tested on the content. The first was a descriptive passage, the second was a narrative, and the third was an expository selection. The time required by a pupil to read an entire selection was used in computing his rate score. Comprehension was measured through the use of objective tests on the content, given immediately after each passage was read. The rate scores were added together for a total rate score and the comprehension scores were combined for a total comprehension score. These total scores were then correlated. The correlation coefficient was as follows:

$$r = .089 \pm .070$$

This coefficient is but little larger than the probable error and is clearly insignificant.

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[6] The Spearman-Brown formula is

$$r_{nn} = nr_{11} / 1 + (n - 1) r_{11},$$

where r_{nn} is the predicted correlation, r_{11} is the correlation between forms of the test, and n is the number of times the test is lengthened. (Holzinger, Karl J. *Statistical Methods for Students of Education.* Boston: Ginn and Company, 1928, p. 169.)

INTERPRETATION OF THE FINDINGS

A general statement is scarcely warranted by the results secured with these two groups of pupils, as there is no certainty that the subjects read the test material at the same rate or with the same degree of comprehension that they read under other conditions. It is known that rate of reading varies with the purpose for which the reading is done.[7] The fact that the pupils were informed before they read that they would be asked to answer questions on the material doubtless had considerable influence on the results. The purpose of giving this information was, of course, to secure *comprehending* reading and to prevent careless pupils and pupils who wished to exceed the rate of their classmates from skimming hurriedly over the material without getting the meaning. The directions probably had the desired effect on many of the pupils, but it is possible that, notwithstanding the instructions, some pupils moved their eyes over the pages so rapidly that they did not really *read* the material. Rate and comprehension would be negatively correlated for those individuals.

It is possible, furthermore, that the information concerning the questions had an undesirable effect in some instances by causing very conscientious pupils to read with meticulous care, or even to reread passages in the selection. If the instructions had such an influence upon the reading of some of the pupils this fact may have led to negative correlation between the rate of reading and the comprehension scores in those cases. It will be recalled that the pupils were told to read as fast as they could read understandingly and were further instructed to read the material only once. As nearly as the examiner could discover from careful observation of the pupils while they were reading, these instructions were followed by the subjects, but there may have been instances in which pupils failed to follow them.

When the preceding limitation of the data is kept in mind, the following tentative conclusion seems to be justified by the findings. It appears that when high-school pupils read with the knowledge that they will be asked questions about the material when they finish reading, the slow and rapid readers answer the questions about equally well. The rapid readers seem to do slightly better with the questions than the slow readers, but the amount of their advantage is negligible.

[7] Gray, Clarence Truman. *Types of Reading Ability as Exhibited Through Tests and Laboratory Experiments.* Supplementary Educational Monographs, Vol. I, No. 5. (Chicago: Department of Education, University of Chicago, 1917), pp. 17-64.

A STUDY OF STANDARD TESTS AND OF TEACHER-MADE OBJECTIVE TESTS IN FOODS[1]

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IN a recent textbook concerned with educational measurements, Ruch says:

"The best of existing standard tests do represent a degree of refinement not possible without extended experimentation. But the rank-and-file of such tests are readily equaled or bettered by the teacher who has mastered a little theory of measurement and who is seriously intent upon building valid and reliable examinations."[2]

The findings of the few experimental studies available which report comparative evaluations of standard and non-standard, objective tests support this statement.[3] The present report discusses the use of standard tests and of informal, objective tests in foods in an attempt to determine whether teacher-made tests are as valid and as reliable as standard tests.

One hundred and sixteen girls in grades ten and eleven, students in the San Diego, California, Senior High School and in the Herbert Hoover High School in San Diego served as subjects for the experiment. All of the subjects were enrolled in a foods course during the second semester of 1930-1931 when the data for this study were collected. Seven tests were used in the investigation: (1) Tests A and B, unstandardized, objective tests in foods prepared by the first writer, given once to each subject; (2) Test C, an unstandardized, objective test in foods, given twice to each subject; (3) Test X, an unstandardized, objective test prepared by three persons for use in a ninth grade foods course, but not prepared

[1] A report based on an unpublished master's thesis from the University of Southern California, 1931. The experimental work was done by the first writer under the guidance of the second. The report was prepared by the second writer.

[2] Ruch, G. M. *The Objective or New-Type Examination.* (Chicago: Scott, Foresman and Company, 1929), Preface, page iv.

[3] Broom, M. E., Douglas, J., and Rudd, M. "On the Validity of Silent Reading Tests." *Journal of Applied Psychology*, XIII (February, 1931), pp. 35-38.

Gibbon, B. H. "An Experimental Study of the Significance of the Teacher-Made Objective Tests in Educational Supervision." Chapter IV. Unpublished Master's Thesis, University of Southern California, 1931.

Lovelace, L. H., and Broom, M. E. "Objective Examinations," *The Grade Teacher*, XLVI (June, 1929), pp. 776-777.

Scudder, J. C. "A Teacher-Made Test in General Science." *High School Teacher*, VII (1931), pp. 36-37.

for use in San Diego schools; (4) the Illinois Test on Foods, a standard test prepared by Ada H. Hess, Georgine Lord, Mabel Trilling, and Anna Belle Robinson; (5) the King-Clark Foods Test, a standard test; and (6) the Streeter and Trilling Food Preparation Test, a standard test designed for use in the junior high school. Test X and the three standard tests were administered twice to each subject.

The technique of correlation was employed in evaluating the validity and reliability of the several tests. Certain other measures of reliability were also computed. This technique was felt to be satisfactory in studying the validity of the measuring instruments, since the standard tests at least had been validated on competent opinion as well as in part by controlled experimental methods. Table I presents the intercorrelations measuring validity and reliability.

TABLE I

INTERCORRELATIONS BETWEEN THE SEVERAL SERIES OF MEASURES, 116 CASES. PROBABLE ERRORS VARY BETWEEN 0.01 AND 0.06. RELIABILITY COEFFICIENTS ARE UNDERLINED. ROMAN NUMERALS INDICATE THE FIRST OR SECOND ADMINISTRATION OF THE TEST SPECIFIED

	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	C, II
(1) King-Clark, I	.66	.50	.51	.35	.40	.50	.56	.45	.41	.47	.51
(2) King-Clark, II		.55	.58	.36	.41	.55	.60	.50	.54	.57	.58
(3) Illinois, I			.78	.44	.34	.68	.62	.58	.57	.58	.59
(4) Illinois II				.56	.44	.64	.71	.60	.56	.64	.62
(5) Streeter-Trilling I					.67	.36	.47	.41	.45	.47	.49
(6) Streeter-Trilling, II						.40	.48	.44	.45	.45	.50
(7) Test X, I							.79	.58	.57	.58	.60
(8) Test X, II								.60	.40	.69	.71
(9) Test A									.86	.61	.63
(10) Test B										.67	.71
(11) Test C, I											.90

Data on the reliability of the several tests are given in Table II. Tests A and B, similar examinations but not equivalent except by chance, are considered as duplicate forms in determining reliability.

TABLE II

MEASURES OF THE RELIABILITY OF THE SEVERAL EXAMINATIONS, 116 CASES

Test	r	k	Index of reliability	P. E. meas	P. E. meas M	P. E. meas S. D.
King-Clark	0.66	0.75	0.81	1.83	.046	.280
Illinois	0.78	0.62	0.88	3.41	.050	.310
Streeter-Trilling	0.67	0.74	0.82	1.22	.077	.403
Test X	0.79	0.61	0.89	3.38	.050	.303
Tests A-B	0.86	0.51	0.93	2.62	.045	.267
Test C	0.90	0.44	0.95	1.99	.034	.218

Kelley says that minimal satisfactory reliabilities as measured by a reliability coefficient determined from the pupils in a single school level

are positive 0.94 with reference to the measurement of the past general scholastic success and the future promise of an individual.[4] None of the coefficients of reliability given in Table II are above positive 0.90. Using the Spearman-Brown technique, it is possible to determine the amount of increase necessary to secure reliability coefficients of approximately positive 0.90 for each test. The King-Clark and Streeter-Trilling tests necessarily would be lengthened x5; the Illinois test and Test X, x3; Tests A and B, x1.5; and Test C, x1, if reliability coefficients of positive 0.90 were to be obtained. If we apply the interpretations given by Odell[5] to the ratios of the probable error of measurement to the mean and the standard deviation, then only Tests A-B and Test C have satisfactory reliability. Summing up the data in Table II, it can be said that only Test C, an unstandardized, objective test constructed by the first writer, has good reliability. Following Test C, the order of excellence, considering reliability only, is Tests A-B, second; Test X, third; the Illinois test, fourth; the King-Clark test, fifth; and the Streeter-Trilling test, sixth.

No direct check of the significance of the validity coefficients is possible, but if we average all the coefficients for each test and for each administration of each test, the order of excellence, considering validity only, is (1) Test C, (2) Test X, (3) the Illinois test, (4) Tests A-B, (5) the King-Clark test, and (6) the Streeter-Trilling test. The unstandardized tests show better validity on the whole than do the standard tests.

In conclusion, there remains only to point out that the findings of this experiment decidedly validate Ruch's thinking, and agree quite well with those of earlier reports. Carefully constructed, informal objective tests prepared by classroom teachers may be made as valid and as reliable as many of the standard tests now available for classroom use. In justice to two of the instruments used in this study, Test X and the Streeter-Trilling Foods Preparation Test, it should be noted that they were prepared for use in the junior high school although they were used in senior high school classes in this study. Since one is an unstandardized test and the other a standard test, however, this fact does not alter the significance of the general conclusion which has been given.

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[4] Kelley, T. L. *Interpretation of Educational Measurement.* (Yonkers-on-Hudson, New York: World Book Company, 1927), p. 29.

[5] Odell, C. W. *Educational Measurement in High School.* (New York: The Century Co., 1930), p. 65.

A CRITICAL SURVEY OF PUBLIC SCHOOL COURSES OF STUDY PUBLISHED 1929 TO 1931*

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(Continued from the September issue)

EXPERIMENTATION AND RESEARCH

Too many courses of study are introduced abruptly without planned preparation and without experimentation. Too many of the so-called tentative courses of study are tentative only in name. We know of one course of study hastily adopted in St. Louis which was later adopted without experimentation in a second city after it was scrapped by the St. Louis schools. Of all the courses of study investigated only 30 or about 10 percent were installed after experimentation. In a certain sense the seventeen activity curricula discussed in the next section are experimental in character. The testing of new units of a course of study may be conducted in a laboratory or experimental center; in several representative districts; or on a city-wide basis. For example, in the Long Beach schools the first draft of a course of study is the work of one person and goes into effect simultaneously in all parts of the city. The second draft is the result of experimentation and is the work of a committee. The new Baltimore course of study in history incorporated suggestions based upon the experiences of teachers during a preliminary experimental period.

The revision of courses of study cannot be achieved without a certain amount of study and research. However, its value depends upon its thoroughness and objectivity. From the point of view of intensive research, 14 or 20 percent of the school systems report some projects in the building of courses of study. Research is reported in 21 or 7 percent of the total courses of study and the total number of projects is 31. The most common research enterprise is that of determining the objectives of a subject. For example, the Kansas City public schools constructed an elementary science course of study partially on the basis of a ques-

*Topics discussed in the September installment of this article were: Survey of Courses of Study, Character of the Output of Courses of Study, Administrative Arrangements, The Introductory Statement of the Bulletin, The Inclusion of Objectives in Courses of Study, Units of Work, The Form of the Unit of Work, The Inclusion of Tests, and, Adapting Instruction to Individuals.

tionnaire to discover the interests of 1000 children. Studies in individualization of instruction rank second in frequency, followed in order by studies in time allotment, grade placement, appraisal, and learning.

With respect to experimentation and research as reported in published courses of study we are able to report much progress over the situation that prevailed two years ago when very little experimentation and research was reported. However, a major professional enterprise, such as curriculum making should be characterized by a greater amount of intensive analysis.

ACTIVITY CURRICULA

While a relatively small number of schools are conducting activity curricula, they deserve special attention because they occupy a prominent place in current educational theory. At the outset, we wish to distinguish between integrated activity curricula in which all subjects are fused into one and activity curricula within the limits of one subject. Both kinds are represented in our survey. Activity curricula are designated by a variety of terms: project curricula, child-centered curricula, and integrated activity curricula. Each of these terms is descriptive of one phase of these curricula. A suitable name for this type of school program has not yet been found nor will it be found until it becomes more general. In general, these curricula have one or more of the following characteristics: 1) the activities are suggested by the children, that is, they are child-centered; 2) subject matter (organized knowledge) is subordinate to experience; 3) practice or drill is provided only when necessary; and 4) the learning outcomes, presumably, are not known in advance.

We found only 17 courses of study which could accurately be classified as activity curricula. Of these, ten courses are integrated, that is, the essentials in the various subjects are the by-products of a unified, child-centered experience. In three courses the core is the social studies and in one, arithmetic. With three exceptions the activity curricula are confined to the primary grades. The courses of study which we have reviewed represent a very small minority of workers on the frontier. From other sources, we learn that some experimentation with integrated curricula in the primary grades is going on in eleven centers. Especially noteworthy, at this time, are the reports of experimentation with integrated curricula in the junior high schools of Raleigh, N. C., Houston,

Texas, Wheeling, W. Va., Greenville, S. C., St. Louis, Mo., State of California, and the University of Oklahoma. It is our impression that isolated cases of integrated activities, particularly in the primary grades, could be found in a great many school districts but that they have been widely introduced is undoubtedly not true. Seven of these activity curricula are such within the limits of one subject. Although the outcomes in terms of mastery of other subjects is indicated, the teacher is left to decide whether the units shall represent an actual fusion of subjects. Some of the courses of study give several illustrative integrated units of which a single subject is the point of departure. In an elementary science course of study, for example, a unit on *The Farm* is the basis for work in language, music, handwork, art, and arithmetic. With three exceptions the single-subject activity curriculum is in the field of the social studies.

MECHANICAL DETAILS

Of the courses of study examined, 196 or 62 percent were printed and 121 or 38 percent were mimeographed. As compared with our earlier survey the percent of printed courses is somewhat larger but this may be due to the fact that our recent collection of courses came to a great degree from centers of large population. Typographically there has been a great improvement in the courses of study in size of type, spacing, handling of captions, and margins. From the point of view of bulk, the courses of study ranged from ten to 465 pages. Fifty-seven percent of the bulletins were over 50 pages in length, and thirty-three percent were over 100 pages in length. It should be remembered that with the exception of sixteen general courses, these bulletins are limited to one subject for a grade or several grades. The mimeographed bulletins from one small suburban city when put in a single pile would reach to the top of a table.

CERTAIN NEW TENDENCIES

Besides the items on our schedule we sought the appearance of new tendencies. We observed that only 115 or 36 percent of the courses of study specified that one or two definite texts were to be used by the pupil. In 73 of the 115 cases the text was to be used in conjunction with references. In 155 or 49 percent of the courses of study no text was specified but a number of references were appended to each unit. We assumed here that the references were to be the chief source of the

pupils' information. Our data seem to show that the tendency is away from the single textbook and toward varied reference material.

We noted an increase in the appearance of various printed materials which are out of the ordinary classification of publications which emanate from the public schools. These included plates for drafting, work sheets in several subjects, practice sheets in arithmetic, practice exercises in language, a treatise on diagnostic and remedial work in arithmetic, a treatise on educational measurements, and a reference book in office training. These represent small experiments in publishing, in fields in which commercial publishers have not ventured or with materials which are of a highly specialized nature.

Three school systems have established laboratory centers for curriculum building. The Elizabeth, N. J., Public Schools have several experimental schools which are experimenting with child-centered activities. Houston, Texas, and Cleveland, Ohio, have established a number of so-called curriculum centers in which new units of work are developed, tested, and eventually published and circulated among all the schools of the city.

To provide for continuous revision about twenty courses of study contain blank pages for teachers' comments. A considerable number of mimeographed courses of study and several printed ones have been issued in loose-leaf form.

LOOKING AHEAD

Our survey of courses of study published in the last three years assures us of steady progress in all of the phases of curriculum revision: in refinement of organization of personnel; in recognition of progressive educational principles; in drawing upon expert guidance; in the application of satisfactory techniques; in extent of experimentation and research; and in the mechanical details.

Judging from our returns and from reports in various other sources there are at least fifteen states which are now in the midst of intensive programs of curriculum revision. These include Alabama, California, Florida, Indiana, Iowa, Massachusetts, Minnesota, North Carolina, North Dakota, Pennsylvania, South Dakota, Tennessee, Texas, Vermont, and Virginia. From similar sources it appears that at least sixteen cities are engaged in major programs of curriculum reconstruction. These include New York, N. Y., Chicago, Ill., Pittsburgh, Pa., New Orleans, La., Indianapolis, Ind., Birmingham, Ala., Grand Rapids, Mich., San

Jose, Cal., Kalamazoo, Mich., Columbia, S. C., Sacramento, Cal., Little Rock, Ark., Santa Barbara, Cal., Muskogee, Okla., Richmond, Va., and Bessemer, Ala.

According to the study of Mina M. Langvick,[3] thirty-one state educational departments formulated a program of continuous curriculum revision within the period of 1928-1930. The actual output of state courses of study rose sharply in 1924 and reached a peak in 1927. Since then there has been a gradual decline in output. If, as we are given to understand, revision is to be continuous, another peak should be reached between 1932 and 1935. While it would be too optimistic to expect this to happen, it is reasonable to expect a considerable amount of revision of state courses of study in the next ten years due to the necessity of correcting the mistakes which inevitably follow radical changes such as we have witnessed in the last ten years.

Applying the same reasoning to city school systems, many of the courses of study produced in the first half of the last decade are due to be revised, especially since most of them were not the product of thorough experimentation. It is our impression that the permanency of the curriculum movement is fairly certain not only because it is intrinsically necessary, but also because it has developed into a most effective instrument of constructive supervision.

[3] Langvick, Mina M. *Current Practices in the Construction of State Courses of Study.* United States Office of Education Bulletin, No. 4. 1931.

REMEDIATION OF COLLEGE FRESHMEN IN SENTENCE STRUCTURE

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THE purpose of this article is to report the procedures utilized and the results attained with college freshmen in a remedial project in sentence structure. The remedial work was administered on an individual basis. The time devoted to the project varied from four to ten hours according to the needs of the students concerned. The average time per student did not exceed five hours.

During their first week in Miami University, 350 freshmen were given the Guiler-Henry *Preliminary Diagnostic Test in Sentence Structure*. By means of this test it was possible to discover the students who were weak in sentence structure and to identify their individual weaknesses. The test covers eight principles of sentence structure, each of which is measured two or more times. Each test item has a value of one point, and the highest possible score is twenty-six points. The test is scored by the right minus wrong technique. In Table II are found the particular principles of sentence structure included in the test. The scores of the 350 freshmen tested in the preliminary survey are shown in Table I.

An inspection of Table I shows that the college freshmen differed greatly in ability to apply principles of sentence structure. Four students attained perfect scores, while three students attained zero scores

TABLE I

SCORES OF 350 COLLEGE FRESHMEN ON THE PRELIMINARY TEST IN SENTENCE STRUCTURE

Test Scores	Frequency
26	4
24	15
22	25
20	45
18	53
16	46
14	40
12	33
10	26
8	23
6	17
4	8
2	9
0	3
−2	2
−8	1
Total	350
Mean Score	14.7
Median Score	16.6

Grade Standards	
Educational Level	Median Score
College freshman	16.4
Grade 12	16.0
Grade 11	14.5
Grade 10	12.4
Grade 9	10.8
Grade 8	8.5
Grade 7	7.5

and three others attained negative scores. This range in scores represents a spread of at least six grades in achievement. The standard for high-school seniors was not attained by 46.3 percent of the college freshmen; 25.4 percent fell below the standard for the ninth grade, which marks the last year of the junior high school; and 11.4 percent did not do as well as the median pupil in the seventh grade, the beginning year of the junior high school.

In order to improve the situation revealed by the preliminary survey, a program of remediation was organized for the 162 freshmen who fell below a score of sixteen, which is the median score for the twelfth grade. Of this number, twenty-seven had withdrawn before the final test was given several weeks later; hence, complete data were available for only 135 students. It is with the latter group, who will be referred to here-

TABLE II

PRINCIPLES OF SENTENCE STRUCTURE WITH WHICH DIFFICULTIES WERE ENCOUNTERED BY THIRTEEN REMEDIAL STUDENTS AND ERROR QUOTIENTS FOR 135 REMEDIAL STUDENTS ON PRELIMINARY AND FINAL TESTS

Principle of Sentence Structure with Which Difficulty Was Encountered	Student													Error Quotients	
	10	20	30	40	50	60	70	80	90	100	110	120	130	Pre-test	Final test
1. A clause used as a subject or as a predicate noun must be the equivalent of a noun. When-, where-, and because-clauses are not noun clauses.	x	x	x	x	x	x	x	x	x	x	x	x	x	.746	.106
2. A relative pronoun must have a single definite noun as its antecedent.	x				x	x	x	x	x	x	x	x	x	.392	.077
3. Complete sentences cannot be used as subjects or predicate nouns with *is* or *was*. (Quoted sentences are exceptions).	x	x	x	x	x	x	x	x	x	x	x	x	x	.387	.052
4. Two or more co-ordinate, independent clauses may be correctly written in one sentence with a semicolon, or as two sentences (not with a comma or unpunctuated) when the co-ordinating conjunction is omitted.	x	x	x	x	x	x	x	x	x	x	x	x	x	.350	.059
5. A relative pronoun must have a definite grammatical use in its own clause.		x	x	x	x	x	x		x			x	x	.240	.066
6. Grammatical constructions must not be left unfinished.		x		x					x				x	.190	.061
7. A true sentence must be independent in grammatical form. (A subordinate clause cannot be a sentence).		x							x		x	x		.059	.027
8. A true sentence must contain a complete thought, *i. e.*, it must have a subject and a verb. (A phrase can never be a true sentence).		x				x		x				x	x	.054	.022
Total	4	7	4	5	5	6	5	5	7	4	5	7	7	...	...
Average														.302	.059

after as "remedial students," that the report from this point on is concerned.

The remedial work was organized on an individual and self-administering basis. An attempt was made to render each remedial student conscious of his particular weaknesses by an analysis of his own test paper. Furthermore, each weak student was encouraged to keep a record of his own difficulties after these had been identified. Individual records of shortcomings for certain students revealed through this method of analysis are presented in Table II.

A study of the error data exhibited in Table II shows a number of significant facts. One is that difficulties in sentence structure are individual and specific. This point is revealed in a number of ways. First, errors were made in applying only three of the eight principles by all of the students represented in the table. Second, the students varied greatly in the number of the difficulties encountered. Student 10, for example, encountered difficulty in applying only four of the principles, while Student 20 experienced difficulty in applying seven of the principles. Third, the principles of sentence structure whose application caused difficulty for the same number of students, did not always involve the same individuals. Thus, while four students encountered difficulty in each of items 6 and 7, only two of the same students made errors in both items. Fourth, the students who made the same number of errors did not always make the same errors. Although Students 40 and 110 made five errors each, only three of the errors were made by both.

The marked variation in the extent to which the eight principles of sentence structure had been mastered by remedial students constitutes a second revelation of the data exhibited in Table II. This statement is well substantiated by the error quotient data for the preliminary test. The error quotient in each case was found by dividing the number of errors made in applying a particular principle by the number of chances for making errors in the application of that principle. The fact that the error quotient considers frequency of mistakes with relation to the number of opportunities for making mistakes makes it a much more valid and significant measure of the seriousness of error than does a mere count of errors. The error quotients for the preliminary test show that the error hazards involved in item 1, for example, as compared with the error hazards involved in other items, were approximately of the following ratios: with item 3, two to one; with item 5, three to one; with item 6, four to one; and with item 8, fourteen to one.

The self-teaching and the individualization of the follow-up work were made possible through the use of *A Student's Workbook in Sentence Structure*,[1] in which the material is organized in a way that makes it possible for each student to secure teaching and practice on the items which give him difficulty. The work was well motivated due to the fact that each student was made to realize that mastery was his individual responsibility. Regular class periods were scheduled for the twenty-five weakest members of the remedial group. During the class hour, the students were encouraged to ask the teacher for help in learning to apply any principle of sentence structure which the self-teaching material in the workbook did not make clear. The remaining students in the remedial group did their work outside of class. They were free, however, to come to the office of the director of remedial instruction for help whenever they felt in need of it. The practice exercises were scored by the students themselves. Correction keys were made available for this purpose whenever the students had exercises to score.

The amount of improvement resulting from the remedial work was measured by the Guiler-Henry *Retest in Sentence Structure*. This test was the equivalent of the preliminary test in content and in difficulty. The passing score on the retest was made several points higher than that for the preliminary test in order to counterbalance the loss of ability which is likely to occur after intensive study and practice have ceased.

TABLE III

IMPROVEMENT MADE BY 135 REMEDIAL STUDENTS IN SENTENCE STRUCTURE

Preliminary Test		Final Test	
Score	Frequency	Score	Frequency
14	38	26	26
12	30	24	41
10	20	22	42
8	18	20	26
6	12	Total	135
4	8		
2	6		
0	1		
−2	1		
−8	1		
Total	135		
Median	12.03		23.98
Average	9.94		22.99

Average Number of Principles of Sentence Structure in Which Errors Were Made

Preliminary test	7.99
Final test	1.53

[1] Guiler, Walter S., and Henry, Ralph L. *A Student's Workbook in Sentence Structure:* A Plan for Individualizing the Study of Sentence Structure. Hamilton, Ohio: Hill-Brown Printing Co., 1928.

If a student failed to pass the retest, he was required to work on the unit until he could give satisfactory evidence that mastery had been attained. Table III, together with the last two columns of Table II, records the amount of improvement that was made.

A study of the data contained in Tables II and III shows that marked improvement in ability to apply principles of sentence structure was made by the 135 remedial students. This statement is well supported by three types of data: (1) The error quotients in the final test were much lower than those in the initial test, the average quotient being reduced from .302 to .059. In all, except one, of the eight principles listed in Table II, the error quotient in the final test was reduced below .1; in four of the principles the error quotient was reduced below .06; and in two of the principles the error quotient was reduced below .03. (2) The average number of principles in which errors were made was reduced from 7.99 in the preliminary test to 1.53 in the retest. (3) The median student score was increased from 12.03 in the initial test to 23.98 in the final test. Interpreted in terms of the grade standards given in Table I, this gain in scores means that the median achievement of the 135 remedial students was raised from less than tenth grade ability to a standard which is far beyond that attained by the typical college freshman. When individual scores are considered, it is found that all of the students receiving remedial instruction attained the standard for their grade in the final test; in fact, the lowest score made by any of the remedial students in the final test was six points higher than the best score attained by any of these students in the preliminary test.

The following summary and concluding statements seem justified by the data that have been presented.

1. Ability in sentence structure is a composite of ability to apply several specific principles in the determination of the structural correctness of sentences; for this reason, learners may be expected to encounter difficulty in the application of one or more of these principles.

2. The college freshmen included in this study varied greatly in their mastery of the field and in their mastery of specific principles. The score of the best student in the preliminary test was many times that of the poorest student. This difference in scores represents a range of at least six grades in achievement.

3. Several of the students manifested outstanding ability in sentence structure. Of the 350 students included in the preliminary survey, four

made perfect scores and 142 students, or 40 percent, attained scores which were higher than the median score for college freshmen.

4. Many of the students exhibited marked weakness in ability to criticize the structural correctness of sentences. More than one-fourth of the students fell below the standard for the ninth grade in the preliminary test and more than one-tenth of them did not attain the standard for the seventh grade.

5. Comparatively few principles of sentence structure offered difficulty for any large proportion of the students. Only one-half of the eight principles caused difficulty for as many as one-third of the students.

6. The students manifested marked individuality in the types of errors that were made. This fact seems to indicate a distinct need for individualized remedial instruction.

7. Marked improvement in ability to use discourse that is structurally correct may be expected when a remedial program first discovers the specific principles whose application is difficult for the group and for individuals and then provides self-teaching and practice materials of types definitely suited to individual needs.

AN ANALYSIS OF ALGEBRA WORKBOOKS

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EVERY biennium sees the appearance of some new idea or device in the educational field. Intelligence tests, achievement tests, the project method, contract schemes to individualize instruction, the socialized recitation—all of these and many others have passed through the stages of enthusiastic acceptance or use, critical evaluation, and finally a proper placing in the realm of things educational. Of late, great interest has been evident in the preparation and use of workbooks and other supplementary class material. We are passing through the stage of enthusiastic acceptance and use. The purpose of this present investigation is to examine critically the contents of nine algebra workbooks to determine the amount of drill material included under the various topics recommended as desirable for the ninth-grade or first-year course in algebra.

It is, of course, realized that algebra consists of more than incessant drill upon mechanics—the particular aspect treated in this study. Problems, for example, and algebraic symbolism, do and should receive attention in a first-year course. Moreover, certain phases of the subject having peculiar social utility—the graph, the formula, and the equation—receive attention in the workbooks. Analyses of the treatment of all these phases of first-year algebra have been made and will form the basis for future articles. If, by means of workbooks, mastery of the mechanical skills can be acquired more readily and more quickly, time may be saved for wider applications of the subject which have greater information and utilitarian value. It is a consummation to be hoped for.

There are at present nine first-year algebra workbooks available for use. The natural first step in analyzing their suitability for a given classroom situation is to ascertain the purposes for which they were constructed. Table I, therefore, gives the aims of each workbook as stated by the authors. We see that such books may be expected to be of the greatest service in measuring the achievement of pupils, in providing drill material for classroom use, in supplementing the textbook, in diagnosing and caring for individual differences, in recording pupil progress, in developing speed by furnishing time limits, and in saving pupil and teacher time. Eight other minor purposes are not listed. Naturally enough, in the different workbooks, the authors have not stressed equally each aim. Therefore, before deciding upon a book, teachers should study the purposes as given by the writer and then examine the book carefully

to see whether the purposes are actually carried out by the material in the book. The analyses here presented should be of considerable assistance so far as drill upon mechanics is concerned.

TABLE I

AIMS OF NINE FIRST-YEAR ALGEBRA WORKBOOKS

	Workbooks*									
	A	B	C	D	E	F	G	H	I	Total
1. Measure pupil achievement	x		x	x	x	x	x	x	x	8
2. Furnish drill material	x		x	x	x	x	x		x	7
3. Supplement the text			x	x		x	x	x	x	6
4. Care for individual differences	x		x	x			x	x	x	6
5. Record teaching progress				x	x	x	x		x	5
6. Furnish time limit		x		x	x	x			x	5
7. Diagnose pupil weaknesses	x			x	x	x			x	5
8. Conserve pupil and teacher time			x			x		x	x	4
9. Develop accuracy	x			x	x			x		4
10. Stimulate interest				x				x	x	3
11. Correct difficulty of pupil	x						x			2
12. Provide material for class period	x		x							2
13. Furnish reviews				x	x					2

* Letters refer to the following workbooks:

A. *C.B.A. Hurdle Tests for Elementary Algebra.* New York: Rand McNally & Co., 1924.
B. Goddard: *Twentieth Century Practice Exercises and Objective Tests in First-Year Algebra.* Fowler, Indiana: Benton Review Shop, 1929.
C. Yeingst. *Practice Exercises in Algebra.* St. Louis, Mo.: Webster Publishing Co., 1928.
D. Goff-Mirick-Mullins. *Work and Test Book in Elementary Algebra.* Evanston: Row, Peterson & Co., 1929.
E. Smith-Reeve-Morss. *Exercises and Tests in Algebra Through Quadratics.* New York: Ginn & Co., 1926.
F. Fowlkes-Kingsbury-Goff. *Algebra Work-Book.* New York: Macmillan Co., 1928.
G. Schorling-Clark-Lindell. *Instructional Tests in Algebra with Goals.* Yonkers, New York: World Book Co., 1925.
H. Myers-Thomas-Persing. *Work Book in Algebra, Part I.* Cleveland: Harter Pub. Co., 1927.
I. Hart. *Diagnostic Tests and Remedial Drills in First Course Algebra.* New York: D. C. Heath & Co., 1929.

For the purposes of this study "mechanics" refers to those exercises which designate exactly the process to be used in solution; that is, the mathematical condition is expressed without any degree of connotation except that which names the process. The term "abstract problem" is a synonym. A "problem," on the other hand, or "verbal problem" would refer to an exercise which demands interpretation, the use of judgment, or understanding of a verbal statement. For example, "Solve for X: $3x - 9 = 14$" is classified as "mechanics;" "Express in words $A = lw$" is classified as a "problem." It is of course realized that an exercise in "mechanics" may actually be a "problem" to the pupil if he is uncertain in his interpretation of the process indicated, but it seems necessary to make some arbitrary distinction as a basis for classification. Each exercise is classified under the highest ability involved; for example, "Add $3b - 6a - 2$, $2b + 4a - c$" is classified under "Add two or more polynomials," not "Add to zero," "Add two monomials with like signs," or "Add two monomials with unlike signs."

The specific skills or topics in mechanics under which the drills in algebraic technique are classified are listed below. The topics are taken

TABLE II

1. Add two monomials with like signs
2. Add two monomials having unlike signs
3. Subtract a monomial from another, both having like signs
4. Subtract a monomial from another with signs unlike.
5. Find the product of two monomials with like signs
6. Find the product of two monomials with unlike signs
7. Divide a monomial by another, both having like signs
8. Divide a monomial by another; signs unlike
9. Mentally multiply the sum and difference of two terms
10. Mentally square a binomial
11. Mentally multiply two binomials of the form $(ax + b)(ex + d)$
12. Mentally square a polynomial of three or more terms
13. Remove a positive parenthesis, and simplify
14. Remove a negative parenthesis, and simplify
15. Evaluate a formula other than trigonometric
16. Evaluate an algebraic expression
17. Change the subject of a formula
18. Simplify a series of arithmetic operations
19. Solve a linear equation
20. Check the solution of an equation
21. Insert a negative or a positive parenthesis
22. Solve a system of equations by using axioms
23. Solve a system of linear equations by substitution
24. Solve a system of linear equations by the most convenient method
25. Solve a system of equations having a linear and a quadratic function
26. Solve a quadratic equation by factoring
27. Solve a quadratic equation by completing the square
28. Solve a quadratic equation by formula
29. Solve a quadratic equation by extracting root of both members
30. Solve a quadratic equation by any convenient method
31. Add two or more polynomials
32. Collect similar terms in a series
33. Check a result in addition
34. Subtract a polynomial
35. Subtract from zero (counting each exercise as one)
36. Check a result in subtraction
37. Multiply a polynomial by a monomial
38. Multiply a polynomial by a polynomial
39. Check a result in multiplication
40. Divide zero by a number
41. Divide a polynomial by a monomial
42. Divide a polynomial by a polynomial
43. Check a result in division or multiplication
44. Find a monomial factor
45. Factor a trinomial square
46. Factor an expression which is the difference of two squares
47. Factor an expression by grouping terms
48. Factor a quadratic trinomial
49. Factor an expression which is the sum or difference of two cubes
50. Form a trinomial square from an incomplete quadratic
51. Find the least common multiple, including the least common denominator
52. Reduce a fraction to lowest terms
53. Change a fraction to equivalent form
54. Combine by addition or subtraction a number of fractions
55. Combine integers and fractions of the form $a + 1/b$
56. Change two signs of a fraction, or check signs of a fraction
57. Multiply two or more fractions having monomial denominators
58. Multiply two or more fractions having polynomial denominators
59. Multiply two or more fractions having mixed denominators

60. Multiply by zero
63. Divide a fraction by another, having mixed denominators
64. Simplify a complex fraction, or a series of multiplications and divisions of fractions
66. Solve a literal equation
68. Solve a proportion
70. Express or simplify a ratio
72. Extract the square root of a polynomial
75. Change a radical expression to one having fractional exponents
77. Combine similar radicals
78. Find the product of two or more radicals
80. Solve a system of linear equations with three or more unknowns
83. Construct a bar or a rectangular graph
86. Draw the graph of a linear equation
88. Interpret a graph
89. Express the facts for, and form an equation involving trigonometric functions, or solve a trigonometric equation
93. Extract a cube root of a polynomial
95. Use the imaginary (i)
96. Remove signs of aggregation and combine terms
98. Simplify a number with a negative, fractional, or zero exponent
100. Differentiate between equality, identity, and impossible statement
103. Solve a system of literal simultaneous equations
104. Raise a binomial to a higher power than the second (Application of the binomial theorem)
107. Solve a system of quadratics
109. Evaluate a trigonometric formula
61. Divide a fraction by another both having monomial denominators
62. Divide a fraction by another having polynomial denominators
65. Clear an equation of fractions, or clear and solve
67. Solve an irrational equation
69. Transform a proportion
71. Find a numerical square root
73. Simplify a radical
74. Rationalize a radical or a radical denominator
76. Change an expression with fractional exponents to one with radical form
79. Find the quotient of two or more radical expressions
81. Plot a point (or identify a point)
82. Construct a circle graph
84. Construct a formula graph
85. Construct a curved or broken line graph
87. Draw the graph of a linear system of equations
90. Use a trigonometric table
91. Raise a monomial to a power other than negative, fractional or zero
92. Extract a root of a monomial
94. Express a coefficient and root as a complete surd
97. Remove signs of aggregation and solve equation
99. Extract the square root of a binomial surd
101. Find the highest common factor
102. Combine by addition (including both negative and positive signs) a row or column of monomials
105. Draw the graph of a quadratic.
106. Arrange terms of an algebraic expression in descending order
108. Form an equation from given roots

for the most part from a list drawn up by W. R. Leuck[1] based upon the *Report of the Committee on Reorganization of Mathematics in Secondary Education* and Thorndike's *The Psychology of Algebra*. Additional topics which appeared in the workbooks were included if they appeared in the list of objectives for the ninth-grade course drawn up by Reeve.[2] Hereafter these skills will be referred to by number rather than name.

[1] Leuck, W. R. *An Analysis of Certain Aspects of Textbooks in First Year Algebra.* (Unpublished master's thesis, on file at Library of University of North Dakota).

[2] Reeve, W. D. "Objectives in the Teaching of Mathematics," *The Mathematics Teacher*, XVIII (November, 1925), pp. 385-390.

TABLE III

AMOUNT OF DRILL ON CERTAIN ALGEBRAIC PROCESSES IN MECHANICS IN NINE FIRST YEAR ALGEBRA WORKBOOKS

Key	Workbooks								
	A	B	C	D	E	F	G	H	I
1	0	53	62	86	90	32	16	122	159
2	0	59	58	124	106	32	24	128	64
3	0	30	79	144	86	33	48	152	261
4	0	24	41	156	98	22	38	203	41
5	48	49	14	64	232	42	24	41	231
6	0	28	18	36	86	19	16	21	68
7	57	43	25	70	124	43	41	59	30
8	3	41	24	66	124	37	53	39	18
9	17	11	60	26	36	9	58	25	57
10	14	45	82	30	134	8	97	0	14
11	73	48	60	0	142	21	43	60	101
12	0	0	2	0	2	2	0	0	0
13	62	22	0	14	68	16	0	27	25
14	102	27	6	12	100	23	9	15	27
15	0	21	20	62	78	27	6	22	70
16	682	46	195	104	0	31	12	42	103
17	76	24	32	32	150	20	35	0	38
18	1	36	1	40	98	70	58	13	7
19	497	119	286	502	770	130	269	170	395
20	0	10	0	114	282	11	0	154	150
21	0	0	0	0	0	0	0	0	0
22	0	0	22	28	0	6	0	0	21
23	0	0	22	0	0	0	0	0	15
24	131	14	12	40	78	35	16	0	31
25	120	0	23	32	36	10	0	0	0
26	0	16	40	24	0	25	0	0	51
27	0	10	0	32	0	10	0	0	24
28	0	6	0	0	0	20	0	0	18
29	0	0	16	0	0	0	0	0	0
30	258	0	50	0	80	0	40	0	0
31	0	33	29	48	64	18	8	38	59
32	0	62	0	0	0	15	10	20	69
33	0	0	0	4	0	0	0	15	0
34	0	39	34	54	78	20	8	66	92
35	0	2	0	20	12	3	2	0	8
36	0	0	0	0	0	0	0	0	0
37	84	41	0	44	104	27	7	73	71
38	2	9	40	50	8	8	8	78	39
39	0	0	0	0	0	0	0	20	0
40	0	2	0	8	6	5	6	1	0
41	0	46	71	32	116	22	5	63	27
42	0	0	98	48	188	18	8	48	30
43	0	0	0	8	0	0	0	10	0
44	62	32	50	92	82	35	96	68	151
45	24	27	57	72	12	14	6	6	2
46	38	23	45	80	38	41	7	72	77
47	0	0	2	0	28	14	0	0	0
48	94	67	136	110	0	36	84	131	176
49	0	0	26	0	0	0	0	0	0
50	0	0	26	0	0	0	28	0	0
51	0	14	0	0	0	1	0	0	4
52	32	36	54	52	78	23	22	0	83
53	0	0	0	84	0	33	0	0	23
54	76	41	34	110	102	51	22	0	232
55	23	46	48	0	78	0	0	0	0
56	0	36	0	0	78	0	0	0	10
57	10	7	56	52	24	16	7	0	43
58	14	8	7	16	20	9	4	0	23
59	9	4	0	6	4	5	0	0	19
60	0	2	0	0	2	1	4	0	14
61	0	28	18	48	58	20	9	0	34
62	0	5	11	22	12	4	0	0	29
63	0	1	0	20	2	1	0	0	25
64	0	20	21	28	42	47	24	0	30

TABLE III—(Continued)

AMOUNT OF DRILL ON CERTAIN ALGEBRAIC PROCESSES IN MECHANICS IN NINE FIRST YEAR ALGEBRA WORKBOOKS

	Workbooks								
Key	A	B	C	D	E	F	G	H	I
65	198	94	142	122	378	27	96	55	170
66	0	26	37	52	56	15	0	0	55
67	34	0	42	36	80	20	0	0	0
68	0	0	0	0	0	5	0	0	0
69	0	0	0	0	0	0	0	0	0
70	0	0	27	0	0	5	0	0	0
71	0	8	20	22	0	0	0	0	40
72	0	0	20	30	34	12	0	0	20
73	31	0	58	38	0	40	0	0	25
74	36	2	48	38	144	0	0	0	23
75	0	0	54	30	40	0	0	0	0
76	0	0	54	30	40	10	0	0	60
77	31	12	40	28	24	20	0	0	12
78	34	0	45	22	10	13	0	0	11
79	1	0	42	2	0	11	0	0	8
80	0	0	17	0	0	0	0	0	0
81	0	0	0	32	0	10	12	0	11
82	0	0	0	0	0	1	0	0	0
83	0	0	1	0	0	2	0	2	4
84	0	0	0	0	2	0	0	1	5
85	12	0	1	2	0	1	0	2	1
86	67	0	0	12	12	0	6	0	5
87	0	0	9	10	32	18	0	0	10
88	0	0	18	12	64	27	27	1	44
89	0	0	0	20	10	0	0	0	7
90	0	0	0	20	0	25	0	0	0
91	30	37	37	62	106	12	2	3	8
92	26	0	101	92	120	8	0	0	0
93	0	0	7	0	0	0	0	0	0
94	0	0	56	0	0	0	0	0	0
95	0	0	0	0	0	0	0	0	0
96	20	4	60	6	28	23	16	86	18
97	0	0	0	0	20	0	0	20	46
98	0	0	210	30	0	18	22	0	0
99	0	0	51	0	0	0	0	0	0
100	0	6	0	0	120	0	0	0	0
101	0	0	0	0	0	0	0	0	0
102	95	40	95	92	154	19	43	50	147
103	0	0	20	8	0	0	0	0	12
104	0	0	18	0	0	2	0	0	0
105	149	0	6	4	0	0	0	0	0
106	0	0	0	0	0	0	0	10	0
107	0	0	0	0	0	0	0	0	0
108	0	0	0	0	0	0	0	0	0
109	0	0	0	0	0	0	0	0	0
Totals	3373	1636	3444	3818	5710	1553	1490	2232	4131

The amount of practice given in the 109 types of mechanics included in the nine workbooks is summarized in Table III. It will be seen that workbooks differ greatly, (1) in the total number of exercises in mechanics, (2) in the number of types of exercises in mechanics, (3) in the degree to which practice is concentrated, and (4) in types receiving particular emphasis. The total number of exercises in mechanics varies from the minimum of 1490 in the case of the Schorling-Clark to a maximum of 5710 in the Smith. Others rank as follows: Fowlkes 1553, Goddard 1636, Myers, 2232, Hart 4131, Hurdle 3373, Yeingst 3444, and Goff 3818.

It is evident that no pupils should be asked to solve 5710 exercises in

mechanics in addition to those in his text. To require him to do so would greatly limit his opportunity to achieve the broader aims of the mathematics courses: there would be little opportunity for a development of the cultural or appreciational side of algebra, or the application of algebraic principles to problem solution or to practical situations. The time devoted to the study of algebra must be wisely apportioned among several activities, with constant caution, as recommended by the National Committee on Mathematical Requirements, against overemphasis on the mechanics.

There is an obvious advantage, however, in having at hand more material for drill purposes that can actually be used. There is then an opportunity for selection. This allows the course an elasticity which might otherwise be lacking. Again, a large number of exercises, if graded or scaled even to a slight degree, will allow for adjustment to changing requirements of classes.

On the whole the gross number of exercises in mechanics is not significant in itself. When considered in connection with distribution by topics, this gross assumes a greater importance. The minimum number of types of mechanics is forty-one in the Hurdle; the maximum is seventy-six in the Fowlkes. The range in the others is: Goddard, fifty-six; Yeingst, seventy-three; Goff, seventy-three; Smith, sixty-six; Schorling-Clark, forty-seven; Myers, forty-two, and Hart, seventy-three.

If the workbook is adopted primarily for intensive class drill on the most important principles of algebra, then one should be chosen which has fewer, but carefully selected, topics and one which has many exercises under each topic. The Schorling-Clark and Hurdle workbooks best fulfill this particular requirement.[3] If the workbook is adopted primarily for individual remedial work, then the greater the variety of topics offered, the more likely it will be that the teacher will be able to find the exact type of exercise which the individual pupils need. A number of the workbooks fill this need admirably: Yeingst, Goff, Fowlkes, and Hart offer seventy-three types or more; Smith offers sixty-six. Of course, a workbook may contain so many exercises as to be too cumbersome for convenience, or offer so few drill topics as to be quite useless. If too many topics are included, there is danger of including some of those which are of little value or no utility. For instance, Yeingst included 7 cases

[3] The Myers' contains mechanics under only 42 topics; but as it covers only the first semester's work in algebra, it must be classified as containing a large number of topics. Part II of this series was still in press at the time this analysis was made.

in the extraction of the cube root of a polynomial, and 51 cases of the extraction of the root of a binomial surd. Both types have been excluded by the National Committee from the course in algebra for grades seven, eight, and nine. On the other hand, if too few types are included, many important and basic skills of algebra must be omitted. For example, the Hurdle workbook makes no provision for the addition or subtraction of either monomials or polynomials as such—only as incidental phases of other drill or testing.

TABLE IV

TOPICS RECEIVING THE GREATEST AMOUNT OF DRILL IN THE VARIOUS WORKBOOKS AND NUMBER OF PRACTICES ON EACH

	Workbook								
Topic	A	B	C	D	E	F	G	H	I
1		53		86		32		122	159
2		59		124		32		128	
3			79	144		33		152	261
4				156				203	
5		49			232	42			231
7		43				43			
8						37	58		
9			60						
10		45	83		134		97		
11		48	60		142				
16	682	46	195	104					
17					150				
18						70	58		
19	497	119	286	502	770	130	269	170	385
20				114	282			154	150
24						35			
30	258								
32		62							
41		46	71						
42			98		188				
44				92		35	96		151
46						41			
48		67	136	110		36	84	131	176
53				84		33			
54				110		51			232
55		46							
64						47			
65	198	94	142	122	378		96		170
73						40			
74					144				
92			101	92					
96			60						
98			210						
102			95	92	154				147
Total	1635	777	1676	1932	2574	737	758	1060	2072

Table IV shows how much concentration occurs and which topics are emphasized most in the various workbooks. We see that the Goddard book has fifty-three exercises on Topic 1; the Goff, eighty-six, and so on across. The total number of exercises included in these topics listed are seen in the column of totals; in each case it is approximately half the total number of exercises given in the book. Drill is concentrated most in the Hurdle book, where four topics include approximately half the total number of exercises. Following in order come the Hart and

the Schorling-Clark which emphasize rather strongly certain topics. The ratios are seven out of forty-seven and ten out of seventy-three topics included in one-half the total number of exercises. The other books, with the exception of the Goddard, are about on a par as may be seen from Table IV, drill being concentrated slightly more in the Myers and the Smith than in the Fowlkes, Yeingst, and Goff. Drill is distributed most widely in the Goddard.

We may consider it axiomatic that important topics should receive a greater amount of drill than those of minor importance. But what are the important topics? There is little agreement apparent in the minds of these writers as expressed in their books. Only one topic, "Solve a linear equation," is found among the preferred group in all nine books. The topics, "Solve a fractional equation" and "Factor a quadratic trinomial" occur in seven. Otherwise there is a great divergence of opinion as may be seen in Tables III and IV.

It might be questioned whether the importance of Topic 98, "Simplification of numbers with zero, negative, or fractional exponents" entitles it to second place as in the Yeingst, or whether the value of Topic 105, "Draw a graph of a quadratic equation," is sufficiently high to warrant the fifth place (with 149 practices!) which the Hurdle workbook allots it. Neither topic is listed by the National Committee as one to be emphasized in algebra for grades seven, eight, or nine.

Although there is a great deal of difference in the difficulty of the exercises included under each type, no attempt has been made to scale them for degree of difficulty. Nevertheless, based upon the close examination made necessary by this study, the writers are of the opinion that the Schorling-Clark and Smith quite consistently emphasize the simpler applications of every principle, while the others include exercises of too great difficulty. For example, Yeingst has included such problems as:

Simplify: $\sqrt[3]{\sqrt{\sqrt[3]{a^6}}}$

Extract the square root of:

$$\frac{a^4}{4} - \frac{a^2b^2}{3} + \frac{b^6}{9} + \frac{a^2c^4}{4} - \frac{b^3c^4}{6} + \frac{c^8}{16}$$

Simplify: $\left[\left\{(a^{-2})^{-3}\right\}^{\frac{1}{3}}\right]^{-2}$

Extract cube root: $27a^3 - 54a^2b + 36ab^2 - 8b^3$

The Hurdle workbook includes 149 exercises in graphing of quadratic equations, a number of which are of the type:

$$y = \pm \frac{2}{3}\sqrt{x^2 - 2}$$

It remains to summarize the drill provided for under the headings of "Radicals and Roots," "Fractions," "Checking Processes," "Factoring, Ratio and Proportion."

According to the Recommendations of the National Committee, the work on exponents and radicals should be confined to the simplest material required for the treatment of formulas. The Committee also recommends that the process of finding the square root of a number be included, but that the drill should not be extended to the extraction of the square root of a polynomial. If these suggestions were followed, it should not be necessary to give these topics a great deal of drill, certainly not as much as the 23.5 percent of the entire amount of drill in mechanics, as in the case of the Yeingst workbook. Excluding the Yeingst, and the Myers I (which includes only the work of the first semester), the percents of the various workbooks devoted to roots and radicals ranges from 1.5 percent to 10.5 percent, the average being 6.9 percent. Without question, the low utility of roots and radicals should limit the amount of practice on these topics. Even six percent seems a high proportion in view of the course outlined by the National Committee. The summarization of the results of the analysis of drill on roots and radicals is given in Table V.

Again consulting the recommendations of the National Committee in regard to the teaching of fractions, we find an emphasis on simple cases. Due to the difficulty which almost all students of algebra experience in mastering the operations with fractions, a somewhat longer time can well be devoted to this topic, and a larger amount of drill is necessary than is the case with skills more easily learned. The percent of practice devoted to fractions varies from 2.5 percent in the Myers I to 23.9 percent in Hart. The average is 14.1 percent. The data are recorded in Table VI.

Very little emphasis is given to checking solutions. Three workbooks do not mention checking or proving solutions. Myers devotes 8.9 percent of his practice to checking; in fact, he follows a consistent plan of requiring a check on some exercises of each type. Certainly all workbooks could profitably devote a larger amount of drill to the checking processes, rather than emphasize less useful skills. Table VII shows clearly the lack of a satisfactory amount of drill in checking, although all types of checking are included in this table. Of course it is not necessary that a workbook fill the need for checking drill, but considering the importance of this skill, it might be well for some space to be devoted to this topic in connection with those topics in which pupils make errors most frequently.

TABLE V

Drill on Roots and Radicals

	Workbooks								
Key	A	B	C	D	E	F	G	H	I
71	0	8	20	22	0	0	0	0	40
95	0	0	0	0	20	0	0	0	0
72	0	0	20	30	34	12	0	0	20
73	31	0	58	38	0	40	0	0	25
74	36	2	48	38	144	0	0	0	23
75	0	0	54	30	40	0	0	0	0
76	0	0	54	30	40	10	0	0	60
77	31	12	40	28	24	20	0	0	12
78	34	0	45	22	10	13	0	0	11
79	1	0	42	2	0	11	0	0	8
67	34	0	42	36	80	20	0	0	0
29	0	0	16	0	0	0	0	0	0
93	0	0	7	0	0	0	0	0	0
92	26	0	101	92	120	8	0	0	0
94	0	0	56	0	0	0	0	0	0
98	0	0	210	30	0	18	22	0	0
99	0	51	0	0	0	0	0	0	0
Total	193	73	813	398	512	152	22	0	199
Total Mechanics	3373	1636	3444	3818	5710	1553	1490	2232	2232
Percent	5.8%	4.8%	23.5%	10.5%	8.6%	9.7%	1.5%	0%	6.4%

TABLE VI

Drill in Fractions

	Workbooks								
Key	A	B	C	D	E	F	G	H	I
101	0	0	0	0	0	0	0	0	0
51	0	14	0	0	0	1	0	0	4
52	32	36	54	52	78	23	22	0	83
53	0	0	0	84	0	33	0	0	23
54	76	41	34	116	102	51	22	0	232
55	23	46	48	0	78	0	0	0	0
56	0	36	0	0	78	0	0	0	10
57	10	7	56	52	24	16	7	0	43
58	14	8	7	16	20	9	4	0	23
59	9	4	0	6	4	5	0	0	19
60	0	2	0	0	2	1	4	0	14
61	0	28	18	48	58	20	9	0	34
62	0	5	11	22	12	4	0	0	29
63	0	1	0	2	2	1	0	0	25
64	0	20	21	28	42	47	24	0	30
65	198	94	142	122	378	27	96	55	170
Total	362	342	391	548	878	238	188	55	739
Total Mechanics	3373	1636	3444	3818	5710	1553	1490	2232	4131
Percent	10.8	20.9	11.4	14.4	15.4	15.1	12.6	2.5	23.9

TABLE VII

Drill on the Checking Processes

	Workbooks								
Key	A	B	C	D	E	F	G	H	I
20	0	10	0	114	282	11	0	154	150
33	0	0	0	4	0	0	0	15	0
36	0	0	0	0	0	0	0	0	0
39	0	0	0	0	0	0	0	20	0
43	0	0	0	8	0	0	0	10	0
Total	0	10	0	126	282	11	0	199	150
Total Mechanics	3373	1636	3444	3818	5710	1553	1490	2232	4131
Percent	0%	.6%	0%	3.3%	4.9%	.7%	0%	8.9%	4.8%

TABLE VIII

DRILL ON FACTORING, RATIO, AND PROPORTION

Key	Workbooks A	B	C	D	E	F	G	H	I
44	62	32	50	92	82	35	96	68	151
45	24	27	57	72	12	14	6	6	2
46	38	23	45	80	38	41	7	72	77
47	0	0	2	0	28	14	0	0	0
48	94	67	136	110	0	36	84	131	176
49	0	0	26	0	0	0	0	0	0
50	0	0	26	0	0	0	28	0	0
69	0	0	0	0	0	0	0	0	0
68	0	0	0	0	0	5	0	0	0
70	0	0	27	0	0	5	0	0	0
Total	218	149	369	354	160	150	221	277	406
Total Mechanics	3373	1636	3444	3818	5710	1553	1490	2232	4131
Percent	6.5	9.1	10.8	9.3	2.8	9.6	14.8	12.4	13.1

In Table VIII are included all exercises in ratio, proportion, and factoring. It must be borne in mind while examining the table, that there is some disagreement among authors in regard to just what constitutes a "proportion." Some include the solution of proportions under the solution of fractional equations, in which each member of the equation is a fraction, and make no mention of proportion as a separate topic. When such has been the case, the writers have classified such a problem simply as fractional equations. The table, then, includes only such exercises as the authors designated as "Proportion" under the topic proportion. Even with this limitation, the distribution of drill is more uniform than that of the other groups so far examined. The minimum is 2.8 percent in Smith; the maximum is 14.8 percent in Schorling; and the mean is 9.8 percent.

In general, then, it may be stated: (1) The workbooks vary greatly in identity of topics receiving emphasis; (2) several show poor discrimination in the distribution of drill; (3) the recommendations of the National Committee have been flagrantly disregarded in a number of cases, but on the whole its influence is evident.

Each of the workbooks has individual unique features. The outstanding feature of the Hurdle workbook is, as the name implies, the arrangement of the material in tests of graduated difficulty, designated by "C," "B," and "A." Upon passing of the "C" test with a perfect score, the pupil attempts "B," which contains exercises and problems similar to those in "C", but of greater difficulty. When he passes "B" with a perfect score, he is permitted to try "A". The chief objection to this workbook is the fact that emphasis is poorly directed, and that many important topics are not included.

In the Goddard workbook the page arrangement is attractive, but the exercises themselves have no great value. There are no alternative forms, no suggested goals, no record of pupil progress. The Yeingst book contains too many exercises of the type discouraged by the National Committee. Too large a proportion of the total number of items is devoted to radicals and roots. The Goff workbook is well-organized and follows its plan consistently. The two forms of each group of exercises increase its value. It offers a wide variety of problems and reviews.

The Smith contains a greater number of items than any of the other books. In the main, the exercises are simple, well arranged, and conform to the requirements of the National Committee. There are two forms of each group of exercises. The book is attractively bound, with allowance for sufficient space for the work of the pupil as well as for the answer determined. Scoring is objective, and answers are to be arranged in columns. A large number of the exercises are multiple choice or true-false. Of particular interest are the exercises on distinguishing between "an equation of condition," an "inequality," and an "identity." This workbook has the best exercises in recognition of terms, principles, and algebraic translation. The graphs are presented effectively.

The Fowlkes book is printed on a poor quality of paper and is bulky in proportion to the number of items included. The binding is too rigid for convenience of the teacher and pupil. The Schorling-Clark workbook is unique in that it provides the pupil with goals which have been validated by experiment. It is compact and well printed. The pupil does not write his results in the booklet as is the case in other workbooks, but uses the book exercises over and over again until he reaches the desired goal. Pupils seem to prefer this form of workbook, probably because of its convenient size and suggested goals.

The Myers book is unusual in that it attempts to teach the processes, whereas other workbooks specifically state that the process must be thoroughly taught before using the book for drill or testing purposes. It makes a very careful analysis (based on Thorndike's analysis of the learning process) of each and every step in any particular process; each step receives minute explanation and specific drill before passing on to the next. Another point of difference between the Myers and the others is the order of presentation. Subtraction is not mentioned until after the completion of addition and multiplication. The book is best suited for use with younger pupils; only a small proportion of the pupils in the average ninth-grade algebra class would find it necessary to devote so

much time to the simplest of the fundamental processes. It might well be used for remedial work with a pupil whose absence had caused him to miss class explanations.

The Hart is an excellent workbook providing definite remedial drill following each test. It also includes a great deal of drill on those parts of arithmetic most often causing errors or difficulty in algebra. There are ninety-two tests, with a large number of exercises to be used for remedial work. Although particularly adapted to the Wells and Hart Algebra, it can be used effectively with other texts.

The degree to which a workbook fulfills its aim depends more upon the teacher using the workbook than it does on the workbook itself. For instance, one of the purposes of the Hurdle book is to group the pupils automatically according to their ability in algebra. But if the teacher ignores the instructions in regard to the passing of each "hurdle" with a perfect score, this aim could not be realized. In the following analysis, however, whenever there is a probable attainment of the aim if the instructions are followed, the workbook has been credited as fulfilling that aim.

If properly used, the Hurdle tests certainly would measure pupil achievement, would furnish drill material, would develop accuracy. It cares for individual differences by offering tests on the same topic, and in three levels of difficulty. It furnishes additional material for use in the class period, and would rank pupils if instructions were carried out.

As the only aim stated in the Goddard workbook is that of furnishing a time limit, and these are indicated in the case of each exercise group, it must be credited with fulfilling its aim. Of course, a teacher might adapt it to aims of her own, but the author suggests none.

The Yeingst does not truly measure pupil achievement, for the exercises themselves are not valid; no standards or goals are suggested; and there is no time limit indicated. It may, however, be used to supplement textbook material for class use and home-work assignments. It might conserve teacher and pupil time in actual writing of the tests or scoring of the results, but the inclusion of material which is of very little significance in the modern algebra course might result in the wasting of more time than is conserved by the other features of the workbook.

The two forms of the Goff exercises aid in measuring pupil achievement; they furnish inventory tests, drill material that is well chosen and well arranged, with a time limit; and they diagnose pupil weakness.

The Goff workbook fulfills its aims to a greater degree than a number of the others; incidentally, its aims are most worthwhile.

The Smith furnishes drill material most abundantly; it measures pupil achievement by means of the two forms for each group of exercises; it furnishes a time limit and should develop accuracy; it consistently emphasizes the algebra most useful in science and in practical work. We must agree that the Smith, to a large extent at least, fulfills its stated aims.

The Fowlkes book can hardly be said to diagnose pupil weakness, but it can be used to supplement a text. It records pupil progress to some extent, and may be used to care for individual differences.

The Schorling-Clark book is probably the most successful in caring for individual pupil differences because of the suggested goals, established by experimental procedure. The pupils record their own progress. The number of topics included, however, as in the case with the Hurdle tests, is comparatively small.

The Myers workbook furnishes a basal text and might act as a self-teacher, since it supplements the material of the text. It seems less successful than some of the others in measuring pupil achievement and in caring for individual differences. The illustrations and explanations may be effective in stimulating pupil interest.

There is ample provision in the Hart workbook for the measuring of pupil achievement and the caring for individual differences. The remedial drills should be a valuable aid to the teacher in developing accuracy. Limits of time are designated. There are means provided for recording pupil progress.

Certain cautions are necessary in the use of any workbook: one cannot expect any and all algebraic ills to be cured by a dosage of workbooks without any preliminary diagnosis of symptoms. Devices of this kind are not unfailing cure-alls for the weaknesses and shortcomings of algebra, although they may furnish, if wisely used, a means for overcoming some of these weaknesses and shortcomings. There must be a careful consideration of class and individual needs before a workbook is selected, and *the* book selected that gives promise of meeting these needs. The careful analysis of each book that is made in this study should aid in a wise selection.

A very practical use for these books would seem to be individual drill upon the less well-learned processes by the particular pupil who does

not know them. Thus, they may help in the application of the Morrison formula of "pre-test, teach, test the result, adapt procedure, teach and test again to the point of actual learning." For example, some of these books provide a practical method of pre-testing as well as for second testing. Or standardized tests might be used for these purposes. Since the drill exercises in many cases are grouped under fairly definite headings, drill may be given upon isolated algebraic skills.

It may be inferred from the above that assignments in workbooks need to be made just as carefully as any other assignments. One cannot rightfully assume that pupils will, of their own volition hunt through the numerous exercises given in workbooks to find remedial drill on their specific weaknesses. This is the teacher's duty.

In conclusion, attention should again be called to the fact that this analysis of workbooks deals solely with their possibilities in furnishing drill upon mechanics; their use in the teaching of problems and algebraic symbolism as well as of the graph are not included, but remain as the basis for further study. Rightly used, workbooks seem to have a legitimate place in algebra instruction. This use, however, will vary with the individual teacher and class. Wrongly or unskillfully used, they represent simply another educational nostrum, the use of which may do more harm than good.

METHODS OF CALCULATING AGES INCLUDING A NEWLY DEVISED SLIDE RULE

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IN practically all schools record cards are kept for each child; group tests of achievement and intelligence are administered, and age-grade distributions made. All of these activities require the laborious task of computing ages either by the age-old processes of arithmetic or by the use of some short-cut device. The growth of educational research bureaus in the past ten years and the resulting increase in the use of educational measurements has been phenomenal.

The questions which face the school or research worker are: (1) How old were the members of this group on a certain date? (2) When will this person attain a given age? The slide rule to be discussed was constructed to solve either of these problems with the following criteria in mind. An adequate device for computing ages should satisfy the following criteria: (1) it should be rapid; (2) it should be accurate; (3) it should give the ages to whatever degree of accuracy required; and (4) it should answer either of the above questions with equal ease.

Since the research worker generally uses a thirty day month, it is possible to use equal divisions on all the scales. In order to simplify the matter further a table of yearly increments was devised. A section of this table (Table I) is given below:

TABLE I

YEARLY INCREMENTS

	Year of Measurement					
Year of Birth	1929	1930	1931	1932	1933	1934
1922	6	7	8	9	10	11
1923	5	6	7	8	9	10
1924	4	5	6	7	8	9
1925	3	4	5	6	7	8
1926	2	3	4	5	6	7
1927	1	2	3	4	5	6
1928	0	1	2	3	4	5
1929		0	1	2	3	4
1930			0	1	2	3

At first glance there is a consistent error of one year in this table. This was done purposely as the problem then resolved into one of always adding the increment as shown on the instrument to the yearly increment. That is, two persons born on June 3, 1909 and December 4, 1909, respectively, would have on September 22, 1930 an age of twenty plus the amount on the scale. The increment added for the former would be one

year, three months, nineteen days; for the latter nine months, eighteen days. If actual year ages were taken the latter would have been twenty-one years (thirty minus nine) less two months, twelve days. It is generally accepted, however, that consistent repetition of an act produces a mental set which is more conducive to accuracy and speed than the shifting back and forth between two activities. Hence, it is better to add consistently since addition is the fundamental arithmetic process.

The calculator is made on the order of a very simple slide rule with four scales, two of which are on a center slide. In attacking a specific problem only two of the four scales are used at one time. Thus, if one tests forty children on November 15, 1930, and wishes to record their ages, place an end point of the center slide above 11-15 on Scale A (Figure 1). This is all the setting the instrument requires. A child

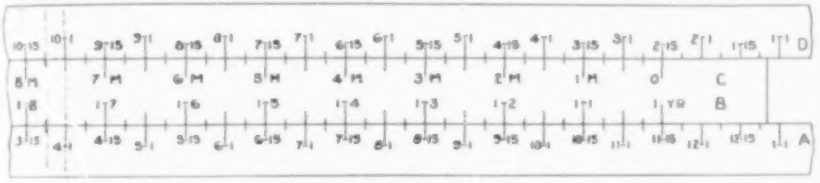

FIGURE 1

born on April 1, 1922 is seven (1930 minus 1922 minus 1) years plus one year, seven months, fifteen days of age. To obtain the increment 1-7-15 look on Scale B above 4-1 (April 1) on Scale A. The point is midway between 1-7 and 1-8 or 1-7-15. A child born on March 23, 1906 is twenty-three (1930 minus 1906 minus 1) years plus one year, seven months, twenty-two days. And so on for all children born before November 15. For those born after November 15, set the other end point of

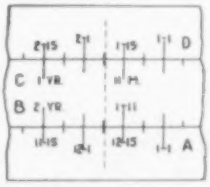

FIGURE 2

the slide above 11-15 (Figure 2) and proceed in a like manner using the increment from Scale C. A birth date of December 8, 1915 gives an age

of fourteen years plus eleven months, seven days. If ages are desired only to the nearest month, one can tell at a glance on which side of the half mark the age will fall since six months, fifteen days is six months, while six months, sixteen days is seven months.

The second question may be answered in a similar fashion by using Scale D instead of Scale A.

One might well ask if this is an improvement over other methods of calculating ages. To date the writer knows of only three other ways: (1) the arithmetic process, (2) the Englehardt-White Age Calculator,[1] and (3) the Young Age Calculator.[2]

Numerous tests have been conducted in an attempt to discover their relative merits in the light of the preceding criteria. The subjects consisted of two staff members of professorial rank, a research assistant in child development, two clerical assistants, and the author. With the ex-

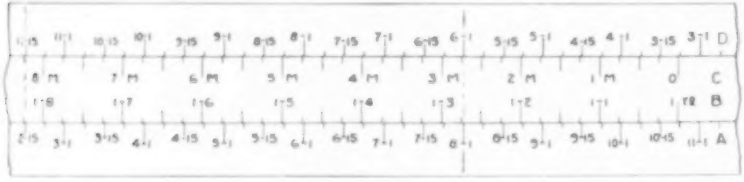

FIGURE 3

ception of D, all the subjects were timed on the use of the slide rule ten or fifteen minutes after they had seen it for the first time.

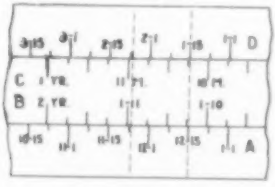

FIGURE 4

[1] The Englehardt-White Age Calculator is built to give ages to the nearest first of any month or as of September 1 or March 1. There are two sectors on a revolving scale, one for finding the age as of September or March first and the correction to the month sector.

[2] The Young Calculator is built to tell how many full years and full months a child has lived. There are two slides and two envelopes, one of which is laid on the other to get the age. Through the use of other tables the age may be found in years and fractions of years, years and months, or months.

The time required and errors made by each of the six subjects in computing forty ages by the methods listed are given below:

	Slide Rule		Arithmetic		Englehardt-White Age Calculator	
Subject	Time, Minutes	Errors	Time, Minutes	Errors	Time, Minutes	Errors
A	7	0	9	2		
B	12	0	12	2	15	6
C	11	1	20	1		
D	6	0	7	1	13	16
E	9	4	14	0		
F	18	2	13	2		

The test consisted of a list of forty birth dates for which the age was to be computed for a given date, June 15, 1930. The birth dates were taken at random from record cards. June 15 was chosen since there would then be even chances of having to borrow months or days in using arithmetic.

From the above results, it is evident that the Englehardt-White Calculator is neither rapid nor accurate. A different setting is required for every age calculated. It gives ages only to the nearest first of any month. Even the degree of accuracy shown above was only obtained by the operators giving a most strict attention to the relation of each birth date to the first of a month.

The case of arithmetic is practically the same. It was neither as rapid nor as accurate in most of the trials. It is necessary to borrow in subtracting in some cases and not in others. And on the whole it can never be done mechanically perfect.

A comparison of time and errors in using the Young Calculator is not necessary since the ages are given only to the full month, whereas the slide rule gives any desired accuracy. This restriction is important due to the fact that practically all studies in child development and insurance and at least 50 percent of the research in education use ages calculated to the nearest unit, be it month or year. That is, six months, fifteen days (or less) should remain six months while six months, sixteen days (or more) should become seven months. This principle is simply an extension of the general agreement among statisticians that one should be added if the decimal is over 5, *i.e.*, 7.6 becomes 8 while 7.4 remains 7.

Our final criterion was that the instrument should answer either of two questions with a minimum amount of effort. The slide rule is the only one of the three instruments with which it is possible to answer the second question.

EDITORIALS

WHITHER EDUCATIONAL RESEARCH?

In decades past, the term *educational research* has connoted in popular thinking applied research in contradistinction to pure research. Educational research has suggested investigations having some immediate significance. These investigations have been conducted for the purpose of securing facts upon which to base the selection of subject-matter, the choice of teaching procedures, or the determination of administrative policies. The conclusions reached were of singular importance in that they had immediate usefulness in the formulation and control of supervisory or instructional techniques, or of administrative procedures. Pure research, on the other hand, constituted those investigations undertaken for the mere discovery of truth itself, with little or no regard to its future usefulness. Often the generalization resulting from the so-called "pure research" proved to have great practical value, but the discovery of true relationships or laws, not their practical applications, was the incentive which promoted the investigations.

As the writer has surveyed the investigations in various volumes of our educational journals and has read numerous articles recently submitted for publication in this Journal, he has, time and time again, wondered whether or not educational research is losing its so-called practical value and is taking on more and more of the characteristics of pure research. A large portion of currently reported investigations may have practical value and immediate application for the highly trained specialist, but it is questionable whether the studies possess these values for the general run of teachers, supervisors, or administrators. Too great a proportion of the best of the educational investigations possess one of three characteristics: (1) being such an infinitesimal part of an important general problem, and being so safe-guarded through the application of the law of a single variable that the experimental conditions become so artificial that any forthcoming conclusions have little chance of aiding in the solution to the general problem; (2) being a very carefully defined, planned, and controlled investigation with ade-

quate data and interpretations about a problem or phase of a problem which is of no general interest to the teaching public; (3) being a topic of general interest but treated in technical fashion, utilizing such involved formulae and equations that only those equipped with knowledge of the latest statistical contributions may attempt to read. These characteristics are merely the usual outcomes evolving from the stabilization of the research activities in educational processes and practice and from refinements in experimental techniques, and may predicate a future cumulative effect of real significance. However, it seems well to make a plea for the encouragement of investigations involving: a program for measuring the effects of a single variable in many and sundry related situations in order to determine whether the conclusions may be harmoniously synthesized into workable theories and practices; the selection of larger and more vital problems undertaken under less artificial conditions so that evolving generalizations will have larger and more significant bearings on major issues confronted; the utilization of adequate but simple techniques so that the results of the investigation will bear meaning and conviction to the consuming educational public and be a source of inspiration and stimulus to activity to prospective but less technically trained research workers. Unless such investigations are forthcoming in greater volume in the future than in the immediate past, the time is not far distant when the investigations in education may well be characterized as pure rather than applied research.

CLIFFORD WOODY

REVIEWS

Address all communications relative to book reviews to Editor E. J. Ashbaugh, Miami University, Oxford, Ohio.

CATTELL, J. MCKEEN, EDITOR. *Leaders in Education:* A Biographical Directory. New York: The Science Press, 1932. vi + 1037 pp.

This educational Who's Who appeared in April, 1932. The preface states that the number of biographical sketches in the volume exceeds 11,000. If the reviewer's count is correct the number of sketches is 11,248. The longest sketch is that of a well-known university president; it contains 62 lines. The shortest, that of a county superintendent of schools, contains 2 lines. A count of the lines in 60 consecutive sketches gives an average length of 12 or 13 lines.

The reviewer has undertaken to determine the probable extent to which *Leaders in Education* overlaps *Who's Who in America*. This was done by checking 1000 consecutive sketches from *Leaders in Education* against *Who's Who in America*.

As a result of the check it was found that 47.3 percent of the 1000 names were also found in *Who's Who in America*. Assuming that the same ratio holds for the entire volume, the subjects of 5,320 of the sketches in *Leaders in Education* are also represented in *Who's Who in America*. This means that those who have access to *Who's Who in America* will find about 5,928 new names in *Leaders in Education*.

As the 1000 names were checked it became apparent that many of those whose names were found in both volumes were the names of persons whose interests lay in the various subject matter fields rather than in the profession of education. That is, they were not Educators with a capital E as someone has undertaken to make the distinction. In checking the second 500 of the 1000 names from *Leaders in Education* a tabulation was made of the indicated professions as given in *Who's Who in America*. Two hundred thirty-two of these 500 names were found in *Who's Who in America*. The list when alphabetized appeared as follows:

One Agricultural Economist, 2 Anatomists, 2 Anthropologists, 3 Authors, 2 Biologists, 1 Bishop, 1 Blindness Prevention Expert, 2 Botanists, 1 Ceramic Educator, 1 Chautauqua Institute President, 6 Chemists, 1 Church Official, 1 Civil Engineer, 9 Clergymen, 2 College Deans, 65 College Professors (6 in Education and 1 in Educational Psychology), 21 College and University Presidents, 1 Dairy Husbandry Expert, 1 Dental Surgeon, 3 Economists, 1 Editor (Industrial Education), 46 Educators, 1 Geographer, 6 Geologists, 1 Headmaster, 1 Historian, 1 Home Economist, 1 Journalist, 3 Lawyers, 3 Librarians, 3 Mathematicians, 5 M.D.'s, 3 Musicians, 1 Music Publisher, 1 Naturalist, 1 Orientalist, 2 Paleontologists, 1 Pathologist, 1 Philologist, 5 Physicists, 1 Physiologist, 1 Plant Pathologist, 1 Provost (College), 4 Psychologists, 1 Registrar, 1 Research Director (Business), 1 Researcher (Physics), 3

Sociologists, 1 Teacher of Singing, 3 Theologians, 2 Zoologists.

How many of these 232 persons are Educators with a capital E? Undoubtedly the 46 which are called educators should be so classified. So, probably, should seven of the 65 college professors and the one editor as is parenthetically indicated. There is doubt as to the 21 college and university presidents, the two college deans, the one headmaster, the one home economist, the four psychologists, and the three sociologists. The remaining 146 are probably persons who have more interest in their subject matter fields than in education as a profession.

In the first 500 names checked the number found in both lists was 241. The professional occupations of the remaining 259 found in the first 500 names checked in *Leaders in Education* but not found in *Who's Who in America* were determined by examining their sketches as published in *Leaders in Education*. They are as follows:

Sixteen in Administration in City School Systems, 43 City School Superintendents, 16 College Deans, 8 College Presidents, 98 College Professors, 9 County School Superintendents, 6 Deans of Women, 2 Editors, 1 Elementary Demonstration Teacher, 27 High School Principals, 1 Lawyer, 2 Librarians, 2 Private School Principals, 4 Professional Organization Employees, 2 Publishing Company Employees, 3 Registrars, 4 in Special Forms of Education, 2 Special Psychologists, 7 in State Departments of Education, 2 Teachers in Public Schools, 1 in the United States Office of Education, 1 writer.

College professors constitute the largest group in this list as in the former list. A little over one-half of these are professors of education and educational psychology. It is clear that a decided majority of these 259 are educators in the sense in which this term is very generally used.

A comparison of the two lists and an examination of the sketches indicate that many college and university teachers of non-educational subjects who are sufficiently distinguished to have their sketches in *Who's Who in America* have been included in *Leaders in Education*. There are, of course, many thousands of other college and university teachers who have not been included.

Leaders in Education will be a valuable addition to the schoolman's library. It gives information not previously available for several thousand educators. Why the volume should include the names of many college professors whose accomplishments have won them a place in other directories and exclude many others not so listed but certainly as important in education as the county superintendent whose sketch requires two lines, is not apparent. This criticism should not be taken too seriously, however. The compilation of this directory must have been a large undertaking. It is a meritorious piece of work and should win the lasting gratitude of the profession.

Not all of the great are included and certainly not all of the included are great. But let it be said to the credit of Dr. Cattell that those who were included were not given to understand that inclusion was conditioned upon their buying a copy of the directory. It is worth buying but no pressure was used to promote sales.

R. L. MORTON

Ohio University

Review of Thirty-first Yearbook, Part II, of the National Society for the Study of Education. *Changes and Experiments in Liberal-Arts Education.*

Colleges of Arts are not static. Nearly fourteen hundred accounts of "changes and experiments" which were in progress during 1929-31 in colleges of arts throughout this country, are recorded, and one hundred twenty-eight of the most significant of them described in the Thirty-first Yearbook, Part II, of the National Society for the Study of Education.

The study was made by nine regional committees organized with the sponsorship of a National Advisory Committee, and under the direction of Miss Kathryn McHale, Director of the American Association of University Women. While the Yearbook recounts many "changes and experiments" which had been described previously in the educational literature of the country, there are many accounts not found elsewhere, and the compilation of so many in one volume, classified as to type and region, constitutes a very useful publication.

Discussions of the significance of the trends in college changes, written by leaders in the college field, make up one very interesting and valuable chapter. The sixteen statements concerning future possibilities in Liberal-Arts education by as many college leaders are very stimulating. Separate chapters on important problems in college education by Miss Kathryn McHale, Miss Agnes Rogers, Dr. Alexander Meiklejohn, and Dr. Hamilton Holt, and a final chapter containing a selected bibliography complete the contents of the Yearbook.

The movements which are most alive in the American college are well brought out.

(1) Selective admission followed by increased attention to the individual abilities and aptitudes of students. This calls for a wide variety of tests and personnel data which are being devised, assembled, and administered by specially appointed faculty members with the aid of national committees.

(2) In the curriculum readjustments which are taking place so generally, the key is coördination of materials from several departments so as to give them more significance and interest to students. To accomplish this purpose, examinations more comprehensive than the content of a single department are rapidly coming into use.

(3) A wide variety of plans of independent study are reported, involving several types of tutorial instruction.

(4) There is a growing recognition of the educational break between the first two and the last two years of the liberal arts college. The junior college organization finds much support in the "changes and experiments" reported.

F. J. KELLEY
United States Office of Education

EATON, T. H. *College Teaching: Its Rationale.* New York: John Wiley and Sons, Inc., 1932. xii + 264 pp.

Examination of the titles of recent publications dealing with higher education reveals certain definite trends with respect to the type of writing represented. Professional groups of teachers and administrative officers are making available addresses delivered or investigations conducted, as in the yearbooks of the National Society of College Teachers of Education and in the annual volume reporting the addresses delivered at the Chicago meeting of administrative officers in higher institutions. Numerous monographs in the form of graduate theses or other intensive investigations,

sometimes subsidized by the educational foundations, have appeared. A decided interest in coöperative studies of the survey type is evidenced by investigations of national, regional, denominational, state, and local scope, for example, national surveys of land-grant colleges and of teacher training, and of Methodist and Lutheran higher institutions. An increasing number of textbooks on college organization, administration, and teaching is available, with a tendency to base conclusions and recommendations on factual data. The extent of the literature available has made desirable and necessary bibliography and summary publications, which represent another type of activity. The rapid development of many types of higher institutions has resulted in certain subjective, critical evaluations such as that of Flexner.

A new book is a constructive, although subjective, analysis of the philosophy of college teaching. The emphasis is on the waning of teaching rather than on specific devices. The author opens the discussion with a statement of his conception of higher education and the part played by teaching. "The ideal of democracy requires that higher education should guide the able few to learn what only the able few can learn" (p. 1). The volume is divided into thirty sections, each of which consists of three parts: one or more propositions, one or more examples, and elaboration of theory and illustration. Among the topics discussed, with the titles in some instances paraphrased, are: learning as activity, the *milieu* of teaching, objectives in different types of teaching, principles of learning, self-activity, attention, interest, media of presentation, selection and organization of subject matter and illustrations, and methods of teaching in different types of learning (appreciation, deliberate action, habitual action, and attitudes). A supplementary discussion of mental discipline is included.

The principles are concisely stated, although in terms somewhat different from those commonly found in textbooks on secondary and elementary school methodology. Examination of the table of contents gives the impression of some duplication and overlapping in the principles formulated; this may be expected in the case of a book organized in thirty sections rather than in eight or ten chapters. The illustrations are interesting and in many instances exhibit a keen sense of humor. The elaboration of principles and illustrations is adequate, although not always easy reading. The book can be read with profit by college teachers in general, especially the beginner. The principles and illustrations in many instances can be applied to teaching in secondary schools.

CARTER V. GOOD
University of Cincinnati

KOOS, LEONARD V., AND KEFAUVER, GRAYSON N. *Guidance in Secondary Schools.* New York: The Macmillan Company, 1932.

It is not often that a book so fully achieves the aims set by its authors in the preface as does this one. With the multiplicity of practices which have grown up in recent years in the field of guidance, it is an ambitious project to attempt in one volume "to give a systematic and comprehensive treatment of guidance in secondary schools—the need for it and its scope, procedures and organization." Clear-cut organization and skillful methods of treatment of material enable the authors to attain their purpose to a remarkable degree.

The philosophy of guidance, the need for it, and its scope, is dealt with in somewhat summary fashion in an introductory chapter of 27 pages. The remainder of the more than 600-page volume is given over to a descriptive analysis of current guidance practice—both as to detailed procedures and broad administrative forms of organization. The introductory chapter, despite the fact that it treats of so much in a relatively small number of pages, is a notable contribution. In a time when guidance is torn between two friendly forces—on one side those who would resolve the movement into a body of mechanical testing techniques for a purely vocational purpose—and, on the other side, those who would swallow up guidance by making it merely a redefinition of education—the treatment of these authors in clarifying and delimiting the scope of guidance is in the nature of a timely rescue. In a few well organized paragraphs the authors perform an invaluable service in telling what guidance is *not*—a service which just now is almost as valuable as telling what it is.

The text proper is in four major divisions: informing students concerning opportunities; securing information concerning students; guiding the individual student; and organizing guidance service. Each section is a veritable mine of information concerning practices and procedures in these various guidance fields. Throughout the authors very properly point out the need for extreme care in the adoption of practical devices, and for the most part they have confined their efforts to a description of practices and existing guidance methods without any attempt to evaluate any form of procedure. At the close of each of the chapters there is a set of well formulated questions and problems and an excellent list of selected references. The book is a distinctive contribution to the literature of guidance movement—a very thorough presentation of the developments to date.

DeWitt S. Morgan
Principal Arsenal-Technical High School, Indianapolis, Indiana

Webb, L. W., and Shotwell, Anna Markt. *Standard Tests In The Elementary Grades.* New York: Ray Long and Richard Smith, Inc., 1932. xiv + 532 pp.

This book is intended for teachers in the elementary school and as an introduction for students preparing to teach in the elementary grades. It is limited to the testing of nursery school children and pupils in the first six grades.

Part I, consisting of 84 pages under four chapter headings, deals with such topics as the need for accurate measurement, types of educational tests, general characteristics of intelligence and achievement tests, and the interpretation of test results. The last topic just mentioned consists of a chapter of 31 pages treating rather briefly such statistical topics as the frequency table, measures of central tendency, measures of variability, and measures of relationship.

In Part II, comprising 92 pages, there are chapters on intelligence tests for nursery school and kindergarten children; intelligence tests for grades one, two, and three; and intelligence tests for grades four, five, and six. The bulk of space in these chapters is given to a description of tests suitable for the various grades. Thus there are descriptions of 26 individual and group tests of intelligence. Each chapter closes with a very brief statement of the uses of intelligence tests in grade placement, homogeneous grouping, diagnosis, etc.

Part III is devoted to achievement tests and consists of 336 pages organized in twelve chapters. Eleven of these are concerned with tests for reading, arithmetic, spelling, handwriting, language, English composition, geography, history and civics, music, art, and general tests. About four-fifths of the space is used in describing tests available for testing measurable aspects of the various school subjects, a total of 85 tests being thus described. In addition, each chapter lists selected tests (including those described) with information such as grades in which the test may be used, cost, type or function of test, and the name and address of the publisher. There are brief but rather good statements of purposes and objectives of the various school subjects as well as short discussions of the uses of the various types of tests. The book concludes with a chapter of 16 pages on non-standard classroom tests in which the main topics are: the improvement of essay or old-type tests, new-type or objective examinations, and uses of classroom tests.

The book is well organized and simply and clearly written. It is fairly well documented and has brief but well selected bibliographies. The reviewer's chief criticism would be that an undue proportion of space is consumed in the description of tests with a consequent limitation of space available for the discussion of principles and functions. To the beginning student, the great number of tests described is likely to be very confusing and poorly digested in the time ordinarily allowed for introductory courses. There is danger that he will not be able to see the forest for the trees. On the other hand, if used as a handbook by the teacher in the field, the book should prove valuable in the selection, administration, and interpretation of standard tests for the grades for which it is designed. On the whole, the book is a useful addition to the ever growing literature on educational measurement.

I. N. MADSEN

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GRAVES, FRANK PIERREPONT. The Administration of American Education. New York: Macmillan Company, 1932. 631 pp.

The Administration of American Education is an attempt "to interpret and clarify existing conditions" as they effect the administration of public education. The author conceives the administration of education as a young but rapidly growing science that is affected by and in turn affects the development of education in all its relationships to the social structure.

To the preparation of this volume Frank Pierrepont Graves brought a rich administrative experience, a long apprenticeship in teaching, a scholarship rarely excelled in the field of public education, and a sympathetic understanding of the human problems involved.

His years devoted to the history of education have given him a perspective for interpreting conditions as they now exist and his broad and thorough comprehension of social philosophy has enabled him to see with a clearer vision than most men do the infinite variety of relationships and problems involved in improving the science of educational administration.

In form and organization of material this book is specially adapted to the use of classes in general educational administration, but quite apart from its usefulness as a textbook, it is a book to be read by every principal, supervisor or superintendent who aspires to a deeper

insight into the problems of his profession and who wishes to perceive more clearly the relationships and responsibilities of his own office to that of every other part of the school system and to the social organization of which the school is a part. The spirit and purpose of the book is interestingly depicted in the closing paragraph:

"Only as there is a nice adjustment between the individual and society can the balance be achieved that is essential to successful democracy. From this point of view a new educational philosophy is emerging, which carefully provides for the interests of both, and it is obvious that its doctrines are actually permeating the administration of public education to-day. Any school system that fails to grasp its implications or to embody its principles cannot hope to realize the function of education in America."

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Assistant Commissioner for Elementary Education, State of New York

RESEARCH ABSTRACTS and BIBLIOGRAPHIES

Address all communications relative to research abstracts and bibliographies to Editor A. S. Barr, University of Wisconsin, Madison, Wisconsin.

BULLETINS AND RESEARCH MONOGRAPHS

Abstracts of Dissertations and Theses in Education, 1917-1931, Bureau of Educational Reference and Research, Monograph No. 1, School of Education, University of Michigan, Ann Arbor, Michigan, 1932. 136 pp.

This bulletin contains abstracts of masters' and doctors' dissertations and theses in education for the period of 1917 and 1931.

Abstracts of Theses and Dissertations in Education, Approved in June and October, 1931. Alpha Chapter, Phi Delta Kappa, School of Education, Indiana University, Bloomington, Indiana, 1932.

This bulletin is the sixth in a series of abstracts of theses and dissertations submitted for advanced degrees in the School of Education, Indiana University.

ASTELL, LOUIS A., AND ODELL, CHARLES W. "High School Science Clubs," Bureau of Educational Research Bulletin No. 60, College of Education, University of Illinois, 1932. 77 pp.

Contains an introductory statement, purposes, rules, regulations, activities, and general principles relating to science clubs. Bibliography.

BAKER, BARNEY K. *The Status of the Department of Education and the Functions of its Head in State Teachers Colleges and Normal Schools*, Bulletin of the State Teachers College, Peru, Nebraska, 1932. 15 pp.

A study of the functions of the head of the departments of education in seventy-two state teachers colleges and twenty-two normal schools.

CARR, WILLIAM G. "Crime Prevention Through Education," *Research Bulletin of the National Education Association*, National Education Association, Washington, D. C., 1932. 68 pp.

Contains an introduction to statistics on crime cost and school expenditures, factors associated with crime, the problem of the delinquent child, the social agencies of crime prevention, organizations interested in crime prevention, and a selected bibliography.

CARR, WILLIAM G. "Estimating State School Efficiency," *Research Bulletin of the National Education Association*, Washington, D. C. X, 1932. 131 pp.

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CLEMENT, JOHN ADDISON, AND SMITH, VIVIAN THOMAS. "Public Junior Col-

lege Legislation in the United States," *Bureau of Educational Research Bulletin*, No. 61, College of Education, University of Illinois, Urbana, Illinois, 1932. 61 pp.

This bulletin contains chapters on the general legal status of junior colleges, legal provisions for the establishment and maintenance of junior colleges, legal requirements concerning junior college administrative and academic standards, and a general summary.

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This bulletin contains a statement of the problem, previous studies of the high-school intelligence, sources of the data in the present study, chronological age levels and ranges, mental age levels and ranges, community differences, relation of intelligence levels to vocational interests, and summary and recommendation.

Eighteenth Annual Conference on Educational Measurements, Bulletin of the School of Education, Indiana University, Bureau of Coöperative Research, Bloomington, Indiana, VII, No. 5, 1931. 83 pp.

This bulletin contains papers by Tilson: "A Study of the Predictive Value of Music Talent Tests for Teacher Training Purposes;" by Eikenberry: "A Study in Methods of College Teaching;" by Remmers: "The State High School Testing Program—Some First Results;" by Smith: "The Growing Demand for Research Workers in Bureaus of Educational Research;" by Shannon: "An Experiment with the Lecture Method in College Teaching;" by Jones: "The Psychological Examinations at the Indiana State Teachers College;" and by Brooks: "Predicting Scholarship in the Junior High School."

MARTENS, ELISE H. *Opportunities for the Preparation of Exceptional Children*, United States Department of the Interior, Office of Education, Bulletin No. 21, Washington, D. C., 1932. 42 pp.

This bulletin contains general findings of the study, and a list of courses offered by states and institutions.

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A study of the intelligence, academic background, and socio-economic status of pupils attending trade schools.

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A personality study employing the Adolf Meyer Life Chart, with the material and methods employed in a personality study, and a list of action tendencies. Bibliography.

PETERS, CHARLES C., AND STRUCK, F. THEODORE. *Abstracts of Studies in Education at the Pennsylvania State College*, Penn State Studies in Education, No. 4, Part II, School of Education, Pennsylvania State College, State College, Pennsylvania, 1932. 64 pp.

This is the second volume of abstracts of theses in education at Pennsylvania

State College. Thirty-four theses are summarized.

Research in Higher Education, Bulletin No. 12, United States Department of the Interior, Office of Education, 1932. 133 pp.

This bulletin contains a group of papers under the following headings: Group I, instruments of measurement in the field of college instruction; Group II, student personnel studies; and Group III, administrative measures based upon test results.

RHOTON, PAUL. *Health Misconceptions of Prospective Teachers*, Penn State Studies in Education, No. 5, School of Education, Pennsylvania State College, State College, Pennsylvania, 1932. 79 pp.

The author presents an analysis of the responses of 2379 subjects to a health information test. The author concludes that formal education has failed in a large degree to remove health misconceptions from the beliefs of the individuals here studied. Bibliography.

SMITH, HENRY LESTER, AND O'DELL, EDGAR ALVIN. "Bibliography of School Surveys and of References on School Surveys," *Bulletin of the School of Education, Indiana University*, Bloomington, Indiana, 1932. 212 pp.

Contains a bibliography of school surveys and references relating to school surveys.

"Studies in the Psychology of Music," *The Vibrato*, I, University of Iowa Studies, Iowa City, Iowa, (April 15, 1932). 382 pp.

This bulletin contains papers edited by Seashore on the following subjects: The vibrato in artistic voices; phonophotograph apparatus; the role of pitch and intensity in the vocal vibrato of students and artists; remedial and artistic development of the vibrato; the hearing of the pitch and intensity in vibrato; the timbre vibrato; measurement of the pitch extent of the vibrato on attack, release, and transition tones; the pitch vibrato in artistic gliding intonations; a comparison of the vibrato in concert and opera singing; the vibrato in wind instruments; a study of the vibrato in artistic violin playing; and historical survey of the string instrument vibrato. Bibliography.

WATERMAN, IVAN R. *Equalization of the Burden of Support for Education*, University of California Publications in Education, Vol. VI, No. 5, University of California Press, Berkeley, California, 1932. 73 pp.

This bulletin contains a statement of the problem, the cost of elementary education, the cost of high-school education, the cost of the equalized program, financing the equalized program, and implications arising from the investigation. Bibliography.

RESEARCH NEWS and COMMUNICATIONS

Address all research news and communications to Editor Carter V. Good, Teachers College, University of Cincinnati, Cincinnati, Ohio.

SELECTED BIBLIOGRAPHY ON TECHNIQUES OF EDUCATIONAL RESEARCH AND RELATED PROBLEMS, 1931-1932[1]

CARTER V. GOOD
University of Cincinnati

THIS, the third annual bibliography on research techniques to be published in the *Journal of Educational Research*, is intended to be of service to three groups of individuals: field workers interested in research, graduate students, and staff members of higher institutions. For example, the references listed include discussions of important problems and issues in need of investigation; summaries, abstracts, and bibliographies of research in various fields of education; appropriate techniques and devices for collecting and analyzing data; evaluations of developments and studies in given fields of education; and the training of graduate students and research workers.

The bibliography covers the period from approximately May 1, 1931, to June 1, 1932. This year an effort has been made to compile a more highly selected group of references than those found in the two preceding annual bibliographies, using as one criterion the research interests and needs of field workers. Therefore, no attempt has been made to include references dealing with highly complicated statistical and mathematical procedures and concepts.

Examination of the bibliography indicates certain centers of interest during the period involved (1931-32). Apparently the debate concerning the place of philosophy and of objective or scientific method in education is not yet finished. In spite of, or possibly because of, the completion of 2582 graduate theses with a total of 4651 different studies in education during the school year 1929-30, authors continue to suggest many problems for further investigation, including certain specialized educational areas (radio education, physical education, industrial arts, and personality and conduct). The accumulation of hundreds and even thousands of studies in a given field has made necessary summaries and bibliographies in increasing numbers. Many graduate schools of late have begun publication of volumes of abstracts of the graduate theses accepted. Interesting recent attempts have been made to evaluate the progress accomplished and to predict future educational developments, for example, "Twenty-five Years of Prophetic Achievement," "Educational Development, 1831-1931: A Centenary Survey and a Forecast," "American High Schools in 1960," and "Education in the Year 2031." Discussion of changes in requirements and

[1] Supplementary to bibliographies previously published in the *Journal of Educational Research*, October, 1930, and September, 1931, and Carter V. Good, *How to Do Research in Education*. Baltimore: Warwick and York, 1929.

programs for graduate degrees continues, especially with reference to professional graduate work in education.

In brief, the primary purpose of this annual bibliography is to direct the attention of the reader to present and future trends in research and educational procedure through its references on completed investigations, suggested problems, investigational techniques, and critical evaluations of studies and current practice.

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